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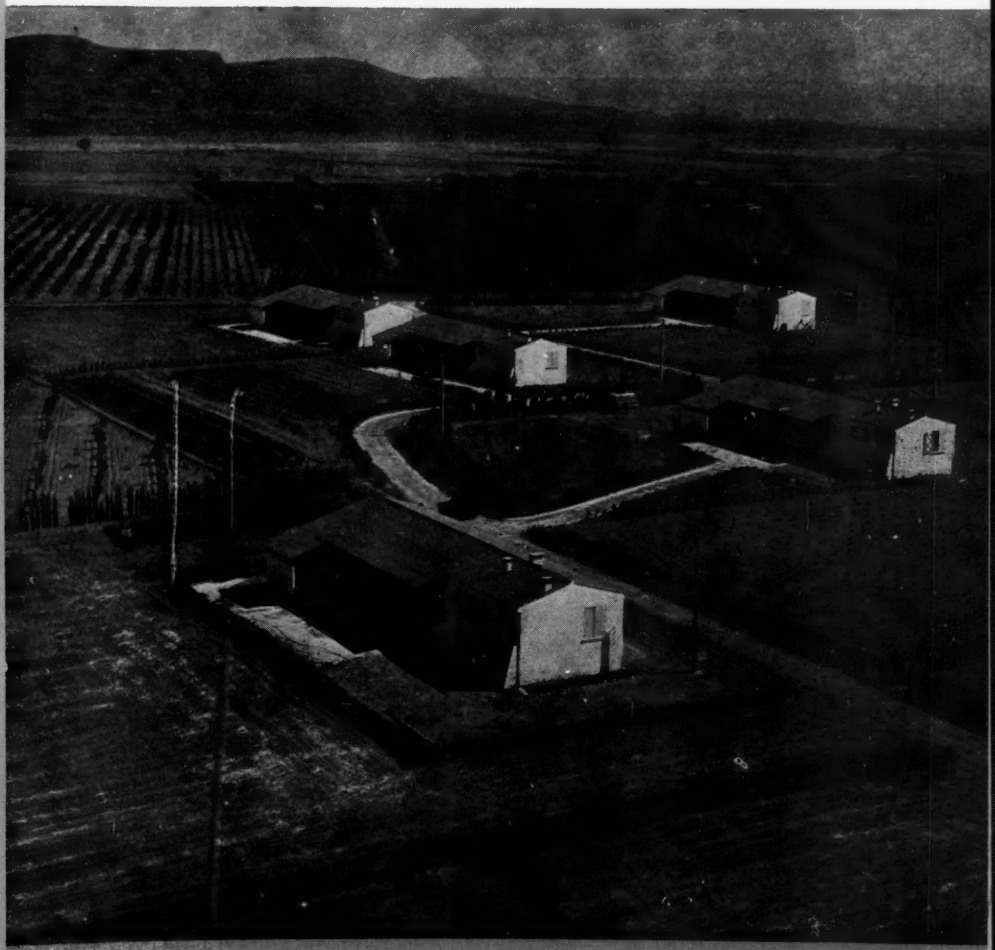

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Agriculture

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This Centre is now a permanent feature of the National Agricultural Centre at Stoneleigh. It affords a display of fundamental techniques in the use of electricity in agriculture, as well as providing conference and training facilities. In addition, there is a technical and product information library also adequate provision for demonstrating new equipment. This new Centre has been established by the Electricity Council to help farmers keep up to date with the latest electrical developments in agriculture. It operates in conjunction with the Demonstration Areas of the N.A.C. where electrical methods are widely demonstrated as part of the many new farming techniques. Advice and information about electric farming methods is freely available from the full-time specialist staff in attendance. Intensive training courses and conference facilities are also available for use by recognised agricultural organisations. The new Centre is designed to meet the needs of all sections of the agricultural industry and to assist farmers in their efforts to increase productivity and cut costs.

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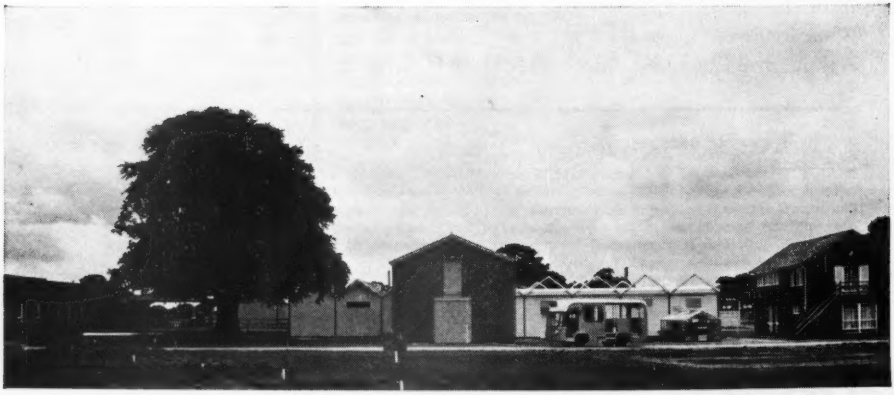

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Full Circle

By year, decade or century, there tends to be some repetition in the affairs of men and farming. The Royal will soon be with us once more—a show as potent in influence as it was a century ago, as different as could be from the show a decade ago and a challenge to the record Royal of twelve months back.

A social occasion?—yes. Some bowler hats to distinguish voluntary workers at the Show from visitors—why not? The rain raineth on all with impartiality! But behind this social occasion is a broad based organization with a will to improve our farming and aid our manufacturers to export. It is the premier international event of its kind and is world renowned. Over 2,000 foreign visitors from some 80 countries come to see and learn. Many later buy our products, stock or technological know-how.

The Show is the focus of the year's work at Kenilworth. It provides the highlights and headlines for many in the technical demonstrations. Round the regular work of the demonstration units—the pig, calf, beef or poultry units and farm buildings, bull testing, Milk Marketing Board and Electro-Agricultural Centres are additional demonstrations of especially topical interest put on for the Show. Today we *live on* ideas. There is always something new to ponder over, argue about, reject, modify or adopt. The Royal Show, at the National Agricultural Centre, provides a feast of ideas. In future there will be a chance to return at leisure during the year and to mull things over with friends, advisers and the Demonstration Unit Managers on 'viewing days' at the Centre.

The Centre would already have had its first experimental year of being open regularly to the public but for the foot-and-mouth disease epidemic. Let us hope it will be luckier in the autumn of 1968 than in 1967.

Last year, well over 50 per cent of the farmers having over 300 acres came to the Royal and with others in the industry provided a record attendance. During May, a great many visitors have been to the demonstration units. Success is measured by service to the industry, not by record attendances. But if hard work and imagination by many people and many organizations spells service, then we should be in for another record.

Christopher Dadd

The Royal Show will be held from 2nd—5th July—it always starts the first Tuesday in July.

The author discusses the commercial application and profitability of 18-month grass-fed beef on a mixed farm

Semi Intensive Beef on a Mixed Farm

Haydn Davies

MUCH publicity was given to the profit potential and technical efficiency of the beef-from-intensive-grass system developed at the Grassland Research Institute in the early 1960s. The claims made for this research-born system were based largely on field scale trial work, conducted initially at the G.R.I. and later at other experimental centres. Little, however, is known of the outcome of the system where it has been adopted as a purely commercial undertaking. One farmer who has successfully incorporated the system into his farm business, and who has kept details of costs, returns and performance over a three-year period is Mr. H. Woodcock, of Avenue Farm, Comberbach in North Cheshire.

Why the system was adopted

Mr. Woodcock owns two adjoining holdings which he manages as one unit. The two holdings amount to 138 acres of ploughable land, well suited to both grass and a wide range of arable cropping. Dairying, naturally enough in Cheshire, is the main enterprise. Subsidiary enterprises are first early and maincrop potatoes (19 acres), corn (30 acres) and the grass-fed beef enterprise.

Because the buildings on both farms were very much outmoded for modern milk production, it was decided in 1959 to erect a yard and parlour for 75 cows at the home farm (60 acres). Since the two holdings are intersected by a busy main road Mr. Woodcock was obliged to confine the cows to the home farm. It was considered that to provide (1) sufficient late May/early June silage for the dairy cows, and (2) an effective grass break for the potatoes and corn, almost half the 78 acres of the further farm should be in grass. This meant that some of this grass, particularly the silage aftermaths, was largely surplus to requirements. This, the presence of vacated buildings on the further farm, and a little surplus labour, encouraged Mr. Woodcock to look for an additional grass utilizing enterprise. This farm organization requirement coincided with the advent of the 18-month grass-fed beef system.

The system

Although the system had been practised since 1963, this article is mainly concerned with the physical and financial performance of the 28 animals born in the autumn of 1965 and finished in spring and early summer of 1967.

The calves were September to early January-born and all, except one, were transfers from the dairy herd. Twenty were castrated males and eight were heifers. All, except one, were Hereford × Friesian. They were weaned and reared on the conventional early weaning system. Post weaning feeding was aimed at giving a daily liveweight gain of about 1½ lb and a turn-out weight of 350–400 lb. No losses were suffered in the rearing period.

The calves were turned out to grass on 28th April, 1966. Concentrates were on offer until they were rejected (after about 10 days). To minimize the danger of husk infection, calves where possible, were first turned on to a previously ungrazed reseed. As an insurance, however, all calves received an oral vaccine.

Fertilizer applications and the rotational grazing management were organized to give a sequence of high-quality grazings. A continuous supply of good grass is essential to prevent any store period at grass. The provision of abundant good quality grass in May and June, as would be expected, presented no problems. Unfouled, worm-free, nutritious grazing during the all-critical months of July and August was ensured by the beasts having access to the silage aftermaths of the 22 acres cut for the dairy cows. Fifteen acres of the most frequently grazed paddocks were then shut up in early July and suitably fertilized to provide an August silage cut for the winter feeding of the beef animals. Unfouled, highly digestible autumn grazing was then provided by the aftermath of the August cuttings. High value autumn grazing was also provided by sowing four acres of catch crop Italian ryegrass after the early potatoes were lifted in July. On average, 150 units of N, 45 units of P and 63 units of K were applied.

In spite of the high level of grassland management, a quite severe setback, due to stomach worms, was experienced in the summer of 1966. Unfortunately, the infestation went undetected for about three weeks. Although a suitable treatment was applied immediately upon diagnosis in late July, the animals seemed to stand still for about three weeks after the treatment. Calves born in December and January appeared to be more adversely affected than the earlier-born calves. As a result of this experience Mr. Woodcock now gives one dose of an antihelmintics in early July as a matter of course.

To compensate for the declining value of autumn grass, the animals received 2 lb of sugar beet nuts per head per day for a three-week period before housing on 26th October. On housing, 2 lb per head per day of ground barley was also fed. Over a period of two weeks the concentrate ration was raised to 6 lb ground barley and 2 lb sugar beet nuts. It was considered that this, in addition to the silage, should make for a liveweight gain of at least 2 lb per day.

By midwinter it became apparent that eight of the smaller animals would not make slaughter weight before the seasonal price slump in June. These were penned separately and fed 10 lb of concentrates per day.

Silage was relied upon to provide most of the dietary protein. It was cut and carted and fed to appetite in a partially gutted shippon (35 sq. ft per beast). It was estimated each animal consumed 45–50 lb per day. The silage had the following analysis:

% *Crude protein*	% *Dry matter*	% *Crude fibre*	*pH*	*Fermentation*
10·6	22·6	36·4	4·3	Satisfactory

The analyst's feeding recommendation was 55 lb of silage with 6 lb of cereal for a daily liveweight gain of 2 lb. Although the silage had a good dry matter content and a good fermentation, the crude protein at 10·6 per cent was considered to be a little too low. A crude protein nearer 12 per cent would have been preferable. However, in spite of the low crude protein, the animals appeared to do well.

Physical performance

The more relevant data is summarized below:

Table 1

Average performance data for the 28 animals born in the autumn of 1965 and finished by June, 1967

Average live weight at slaughter	900 lb (8 cwt 4 lb)
Average dead weight at slaughter	503 lb
Average killing-out	56%
Average age at slaughter	17 months (518 days)
Average daily liveweight gain	1·56 lb
Concentrates consumed in rearing period	4·7 cwt
Concentrates consumed in fattening period	13·7 cwt
Average concentrates fed per lb liveweight gain	2·44 lb
Losses	2 : 1 at 10 months, 1 at 12 months (*dislocated shoulder*) (*Lymphangitis*)
*Stocking rate	1·27 beasts/acre or approx. 5 beasts on 4 acres

Drawing of the finished animals took place from mid-February to early June at weights ranging from $7\frac{3}{4}$ to $8\frac{1}{2}$ cwt (average 8 cwt 4 lb). The lighter animals were the last *drawn*. These were considered to be the least profitable since they required higher concentrate feeding for lower sale weights. These lighter animals, without exception, were the December and January born calves. The most profitable animals were those born in October and November and sold at the heavier weights in March, April and May. Steers were considered to be more profitable than heifers.

The average sale weight of 8 cwt was lighter than desired. Ideally, average weight should have been around $8\frac{3}{4}$–9 cwt (say, range from $8\frac{1}{2}$ to $9\frac{1}{2}$ cwt). The main discernible factors resulting in an over-light weight were:

1. too many late-born calves;
2. worm infestation whilst at grass;
3. too heavy a feeding of concentrates in the early stages of fattening.
   8 lb/head/day (6 lb barley and 2 lb sugar beet nuts) was probably too much in that it encouraged too rapid a finishing. It would probably have been better to have restricted them to 4 or 6 lb per day total concentrates to Christmas. This would have encouraged a bigger consumption of silage and induced a greater development of *frame* on which later to put the *finish* by increased concentrate feeding. Although this might have been more expensive in terms of concentrate use (since food conversion falls with age) it would probably have been compensated for by cheaper liveweight gain in the early stages on the relatively cheaper silage.

Financial performance

Twenty-two of the 26 beasts finally marketed were sold through the F.M.C. at an average price of 3*s*. $2\frac{1}{2}$*d*. per lb dead weight (ranging from

*Because first cut silage was removed for the dairy herd from 22 of the 28 grass acres, stocking rate had to be estimated. The estimation was based on the assumption that one-third of the annual production of the 22 acres was taken as silage for the cows. The 4 acres of catch crop Italian ryegrass was assumed to be equivalent to 1·5 acres of full season grassland. In total the beef animals had the equivalent of 22 acres for 28 animals or 1·27 beasts/acre.

3*s.* 0¾*d.* to 3*s.* 4*d.*). Carcass gradings were 7 'Q' and 15 'A'. The four beasts sold through an auction market averaged £71. There were 2 losses.

Table 2

Average financial data for 26 Animals sold over the period February-June, 1967

		£	*s.*	£	*s.*
Output	Sale value of beast	86	0		
	Less calf cost	15	0		
	Less share of mortality	1	0	70	0
Variable costs	*Feed* (½ cwt milk replacer	1	18		
Rearing	3 cwt proprietary rearing pencils	6	3		
	1·7 cwt home-mix rearing feed	2	16		
		10	17		
Fattening	4·1 cwt sugar beet nuts	4	14		
	9·6 cwt ground barley	10	11		
		15	5		
	Total feed			26	2
	Haulage and insurance			1	5
	Vet and medicines			1	10
	Straw (purchased)			3	0
	Grassland costs			4	0
			Total	35	17
Gross margin/head				34	3

*Sale value per beast, including 2 casualties was arrived at as follows:

	£
Sales—22 F.M.C. beasts at average £84 5*s.*	= 1,853
— 4 market beasts at average £71	= 284
— 2 casualties	= 2
Calf subsidy	= 253
Fatstock guarantee rebate	= 17
	2,409

$$\text{Sale value/head} = \frac{£2{,}409}{28} = £86$$

Gross margin per head (see Table above) was calculated to be £34 3*s.* per head. On an acreage basis this represented a figure of

$$\frac{28 \text{ beasts} \times £34 \text{ G.M./head}}{22 \text{ estimated effective acres}} = £43{\cdot}3 \text{ G.M./acre}$$

This is indeed a good performance. It compares with other enterprises on the farm for the financial year ending March, 1967, as follows:

Enterprise	G.M./acre £
18 months grass-fed beef	43
Dairy cows	90
Winter wheat	38
Spring barley	28
Potatoes (mainly first earlies)	174

Another indicator of the financial efficiency of the beef enterprise was the gross output per ton of concentrate feed, which in this case was £84. This compares with a standard of about £65 per ton of concentrate feed. This indicates that very good use was made of the grass and silage.

Since the introduction of the enterprise used existing land resources and did little to increase the overhead costs of the farm, the total gross margin of the enterprise (28 beasts × £34 = £952) is therefore largely increased farm profit. It should, however, be pointed out that on most farms some extra overheads on buildings, machinery or labour are likely to occur.

Future of system

Mr. Woodcock is so pleased with the returns, the ease of management and the way the enterprise fits into his farming system that he is in the process of doubling up the enterprise to at least 50 head. These he hopes to keep on about 30–35 effective acres of grass. Expansion will entail the provision of a new concrete framed yard for loose housing and an uncovered silo clamp to facilitate self-feeding of silage. No additional labour will be required. After allowing for the increased fixed costs due to the new building works, Mr. Woodcock confidently expects a return on the extra capital of about 20 per cent.

This article has been contributed by **Haydn Davies, M.Sc.,** who is a District Agricultural Adviser with the National Agricultural Advisory Service in Cheshire.

Intensive Cereal Growing—

Soil Structure

T. Batey

THE acreage of cereals grown in Britain has increased considerably in the last few years. Part of this additional acreage has come from the breaking up of old pastures, but much has come from an increase in the number of cereal

crops grown between break crops. It is not uncommon to find four, five or even more successive cereal crops in a rotation though true continuous corn growing is relatively rare. Intensive cereal growing has produced many problems, particularly of disease. Another factor to consider is the long-term effects on soil structure and this article looks at the role of soil structure in intensive cereal growing systems.

Soil texture

Before discussing soil structure in detail it is necessary to define two terms which are sometimes confused, soil structure and soil texture. Soil texture is used to describe the fundamental physical constituents of the soil—the size and proportion of sand grains, the amount of silt or the amount of clay in the soil.

Sand, silt and clay particles have defined sizes:

sand	2 to ·02 mm
silt	·02–·002 mm
clay	less than ·002 mm

For example soil texture classes include such terms as sandy loam, loamy fine sand, silty loam and sandy clay loam. Soils have many characteristics related to their texture and whilst this may vary across a field and also from the surface to the subsoil, it is essentially a permanent feature which cannot be manipulated by agricultural practice. Soil structure, however, is a variable property and refers to the way in which the very small particles of sand, silt and clay are bound together into larger units or aggregates.

Soil structure

In an arable soil the structure is part natural, part man-made. Natural factors such as the action of drying and wetting, freezing and thawing, help to separate the soil mass into units of structure. Once smaller units have formed they are stabilized by the binding action of roots, humus, clay or iron compounds. The size, shape and stability of the units of structure that are formed are related to the texture of the soil. Contrast for example, a clay loam and a sandy loam. The clay loam soil will shrink when it dries in summer, the cracks extending several feet into the subsoil, breaking up the soil into long columns usually with an hexagonal cross-section. The top soil is further broken down into small angular or rounded granules which are stabilized mainly by humus. However, a sandy loam shows no cracking when dry. The individual sand grains are bound together by the action of plant roots, humus and soil organisms. The units of structure that form are more rounded and crumb-like than in the clay loam soil. Soil structure may thus be described in terms of the shape and size of the aggregates. However, the binding agents are particularly important because they determine the strength and thus the stability of the structure. Organic matter and clay particles are the main binding agents in British soils, though in some soils iron compounds also contribute.

While several processes in nature aid the formation of structure others tend to have a disruptive action. When heavy rain falls the soil particles on the surface have to absorb the impact energy of the raindrops, unless the surface is protected by a crop. If the structure is weak heavy rain can break up the aggregates and the surface may revert to an unstructured massive soil.

Most soils can withstand heavy rain but some are notoriously unstable. These are soils containing a high proportion of fine or very fine sand coupled with a low organic matter content. Soils of this texture class, very fine sandy loam, and loamy very fine sand, can run together on the surface during heavy rain and the wet, puddled slurry that forms can seriously affect the growth of crops. Air can be excluded while the capped soil is wet and on drying it may be too hard for roots and shoots to penetrate.

Under arable conditions the natural structure of the top soil is broken up and mixed together by cultivations. The aim is to produce a tilth suitable for the planting, germination and growth of the crop. However, cultivations can also have an adverse effect on soil structure. If soil is worked when too wet a cloddy tilth may be formed. More severe effects can occur in the subsoil. Tractor wheels or the sole of implements may compress or smear the soil and if the soil is wet this compression can be irreversible and a compact structure formed. The reason for emphasizing the importance of structure is that root growth is largely dependent on the physical condition of the soil. Roots need air and moisture to grow and must also be able to penetrate the soil. If there is any check to their downward growth then the reserves of moisture and nutrients cannot be effectively utilized.

Organic matter

As mentioned above, organic matter is one of the important stabilizing agents of soil structure. Organic matter is complex and is made up from crop residues such as roots, stubble or straw which are slowly broken down by micro-organisms in the soil. However, all forms of organic matter contribute to the structure of the soil—the initial crop debris, the intermediate products and the final residue usually called soil humus.

Organic matter benefits the soil both by binding soil particles together and by keeping the soil more porous. A soil low in organic matter can be tricky to work and may be sensitive to damage by heavy rain or by cultivations; in general terms a 'sad' soil. However, a soil with a satisfactory level of organic matter is resilient and can withstand normal cultivations without undue damage. Unfortunately, it cannot be said that by increasing the organic matter content of the soil, it will be able to withstand maltreatment. Whatever the level of organic matter, compact layers can be formed if a soil is compressed when too wet.

This does not mean that organic matter has no value; a difficult soil such as one containing a high proportion of fine sand particles can be much improved by an increased organic matter content. Organic matter adds life to a soil and it is worth maintaining a satisfactory level. But what is a satisfactory level? This depends on the texture of the soil. Organic matter is more easily lost from light soils than from heavy soils. Much can be done to conserve organic matter in the lighter soils by, for example, refraining from deep ploughing as this dilutes the organic matter content of the top soil by distributing it more deeply.

Cereals, provided they are well grown, are not crops that seriously deplete the organic matter. The organic matter left behind as stubble and roots after a good crop is equivalent to about 5 tons per acre of farmyard manure*. If the straw is not burnt, further organic matter is supplied provided it can be incorporated satisfactorily.

*See 'Continuous Cereal Growing.' *Agriculture*, April, 1964.

Cultivations

The objective of most cultivations whether ploughing, rotavating or cultivating is either to break up consolidated layers in the soil, to prepare a tilth for the next crop or to control weeds. In intensive cereal growing systems most cultivations are aimed at weed and disease control. Unfortunately cultivations are usually a compromise between efficiency and timeliness. It is not always possible to carry out the operation at the right time or when the soil is fit enough to work.

With nearly every cultivation there are potential hazards to soil structure which can reduce crop yields. The critical factor is the moisture content of the soil; if the soil is dry enough very little harm can be done. But if it is very wet not only is the cultivation itself inefficiently done but smearing and compaction may pan the soil. The point to bear in mind is that whatever the operation—ploughing, discing, rotavating or cultivating—root development may be restricted if compact layers are formed. The key is to carry out the job at the correct moisture content. Keep off the land when it is too wet.

Soil pans

When wet soils are compressed or smeared the natural structure can be destroyed and the particles of soil squeezed together to form an impervious continuous layer often called a soil pan. When the soil dries out these layers can become extremely hard and roots cannot force their way through. In severe cases roots can be seen bunched together in a layer on top of the pan. Water movement through the soil is also hindered and in winter a very wet layer of soil is often found just above a pan. Air cannot enter so easily and 'anaerobic conditions' may develop within the compressed layer. When this occurs, for example, under tractor wheelings, grey/black strongly smelling zones may be found in the soil, roots of the crop are severely restricted and often yellow lines, related to each wheel-mark, can be seen in the crop.

Some soil pans occur naturally. They may be layers of cemented gravel, zones of clay build-up, or layers of unstable structure which collapse when wet. All too frequently, however, pans are man made. It may be possible to break up natural or man-made pans by subsoiling, but how much better to avoid causing them wherever possible.

Root restrictions

If roots cannot penetrate deeply because of a barrier and are restricted to say the top foot, then moisture and nutrient supplies can come only from this depth of soil. The water held would soon be used and the crop begin to show signs of drought, i.e., drought in the midst of plenty, as there could be enough water in the subsoil below, which is not obtainable because the roots cannot reach it. Similarly, as the top soil dries out, plant nutrients cannot be taken up; crops affected by root restriction often show signs of nitrogen deficiency, even when adequate amounts have been applied.

The effect of root restriction in cereals can have a serious effect on yield. Severe cases have been found where there has been negligible root penetration below 4 inches and the crops have failed to mature. In other cases where root penetration has been restricted to 8 or 10 inches losses in yield of the order of 5–10 cwt per acre have been found depending on the type of soil and the season. One important side effect is that roots already restricted will be worse affected by any soil pest or disease present.

Roots and water requirements

Why emphasize the importance of roots? It is not always realized the heavy demands that are made on root systems. Their function is mainly to anchor the plant and to absorb moisture and nutrients from the soil. While a crop of barley may require say 4 cwt of fertilizer per acre to satisfy its nutrient requirements for the season, about 100 tons per acre of water may be needed to satisfy the moisture requirements in a single hot week in June or July. Over the whole season a cereal crop can use well over a thousand tons of water per acre (100 tons per acre is equivalent to 1 inch rainfall). Water is required partly as a means of moving nutrients within the plant but most of it is lost to the air through the leaves. This process (transpiration) regulates the temperature of the leaf surface and enables the leaf to function correctly. If the supply of moisture is restricted, the leaves become less efficient and when the shortage is severe they wilt. If moisture shortage is prolonged the crop may be stunted and the yield reduced.

The amount of water used is related to crop cover and the weather. On average it is equivalent to about 2 inches of rain in the month of April, 3 inches in May, 3½ inches in June and 3½ inches in July in Southern England. Except in high rainfall areas or in very wet summers in the drier areas, much of the required water has to come from the reserves held in the soil. These reserves fall as the season progresses. If the soil moisture reserves are depleted and the crop cannot obtain enough water, crop performance will be reduced.

The reserves held in the soil are related to the soil texture. Very light soils hold about ¾–1 inch available water per foot depth, light loams about 1½ inches, very fine sandy loams 2½–3 inches and clays 2–2½ inches per foot depth of soil. It is of interest to note that while heavy soils hold more moisture, they release less for crop use than some lighter soils. Plants can wilt in a clay loam soil containing 20 per cent moisture; this is unavailable because it is held so strongly by the clay that the roots cannot extract it.

Soil moisture reserves are not only related to texture but also to the depth of soil that is accessible to crop roots. A soil in which roots can normally go down to 2 ft would have the effective moisture reserves halved if for some reason the roots could not grow below 1 ft. If you dig up a cereal plant it is obvious that most of the roots are in the top 9 inches of soil but by digging deeper fine roots can be found at a depth of 2 ft, 3 ft or even 4 ft in some soils.

Crop yields

Maintaining a high, consistent and profitable yield is the aim of all intensive cereal growers; easy to say, but how to achieve this aim in practice is the problem. Yields are affected by many factors: variety, manuring, cultivations, drilling, weeds, root diseases, leaf diseases and soil pests, together with the effects of the weather. However, the basic material in which the crop grows is the soil.

The essential link between the crop and the soil is the root system. The effectiveness of the roots in obtaining from the soil what the crop needs can have a marked effect on the health, vigour and yield of the crop. A good root system needs to explore the full depth of the soil to exploit the resources of moisture and nutrients. To achieve this an uncompacted stable structure is essential. Soil structure is related to the soil texture, the level of organic matter and to careful cultivation. Organic matter levels may be low in intensive cereal growing systems but the returns of roots and stubble (even

with the straw burnt) from a well-grown crop of cereals should be adequate to maintain a satisfactory level. But the key lies in handling the soil correctly and avoiding compaction. There is no easy way to increase the grain yields on which the whole economy of cereal production depends; every step has to be critically planned and carefully carried out.

This article has been contributed by **T. Batey, B.Sc., Ph.D.,** who is an Advisory Soil Scientist with the National Agricultural Advisory Service in the South-Eastern Region. Previous to taking up his present appointment he was at the Headquarters of the Eastern Region at Cambridge.

The Ministry's Publications

Since the list published in the June, 1968, issue of *Agriculture* (p. 284) the following publications have been issued.

MAJOR PUBLICATIONS

Technical Bulletin No. 6. Common Names of Insects and Other Pests (Revised) 10*s.* (by post 10*s.* 6*d.*)

Fixed Equipment of the Farm Leaflet No. 37. Tree, Bush and Stump Clearance (Revised) 2*s.* 3*d.* (by post 2*s.* 6*d.*)

Fixed Equipment of the Farm Leaflet No. 44. Design of Horticultural Packing Sheds (Revised) 1*s.* 9*d.* (by post 2*s.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 5. Common Scab of the Potato (Revised)
No. 71. Colorado Beetle (Revised)
No. 179. Leatherjackets (Revised)
No. 235. Chafer Grubs (Revised)
No. 322. Taints in Milk (Revised)
No. 370. Cauliflower Mosaic (Revised)
No. 372. Potato Tuber Eelworm (Revised)
No. 552. Maintenance of Fertility in the Large Dairy Herd (New)
No. 556. Rabbit Meat Production—Breeding Principles and Systems (New)

SHORT TERM LEAFLETS

No. 66. Docking Disorder in Beet (Revised)
No. 76. Oil-Seed Rape (New)

UNNUMBERED LEAFLET

Lifting and Carrying (Revised)

The priced publications are obtainable from Government Bookshops (addresses on p. 358) or through any bookseller. Single copies of unpriced items are obtainable only from the Ministry (Publications) Tolcarne Drive, Pinner, Middlesex.

Going Metric

J. B. Freeland

The 10 pence and 5 pence coins are already with us and soon these will be joined by the 50 pence piece. We are finding our medicines prescribed on bottles in ml doses instead of teaspoons. The changeover to metric is, therefore, slowly but surely taking place. The pharmaceutical trade is, in fact, the first section of industry to complete its programme. Whilst the Government has recognized that it is not its function to impose a final date for metrication in industry, each section is urgently engaged in deciding the conversion programme best suited to its needs and resources.

The programme for the general engineering industry will be published shortly and those for both the shipbuilding and electrical industries will follow later in the year. The construction industry programme has already been accepted and is well advanced. By the end of the year all essential reference publications will be available in metric terms. All the technical information in metric terms will have been provided by manufacturers for their products, to enable the British Standards Institution, which is the co-ordinating body, to consider the production of metric dimensional recommendations and British Standards for these products.

So far as the agricultural industry is concerned, discussions are already taking place to enable the preferred metric dimensions for all agricultural buildings to be decided. These must cover external and internal sub-divisions, all the fixtures and fittings as well as the overall structure containing them. The programme for the construction industry provides for these preferred dimensions in metric terms to be used as from next January on plans and drawings relative to building work to be carried out during 1969. As these equivalents start to be incorporated in contracts for building work, the use of the metric system will become legally enforceable.

It is not, therefore, sufficient to leave the business of 'Going Metric' to those producing the information for the changeover. If the conversion programme is to be achieved satisfactorily then everyone concerned in the agricultural industry must start to think in metric and become fully conversant with the use of metric terms now, even though complete changeover is several years ahead. We already have the first of the decimal coins in our pockets. We should also have in our minds mental pictures of a metre, kilo, hectare, litre, etc.

To this end the Agricultural Land Service has co-operated with the Farm Buildings Centre in providing a long term metric exhibit at the National Agricultural Centre at Stoneleigh, where visitors to the Royal Show or on subsequent 'viewing days' will be able to see something of the impact which conversion to metric measure will have on the farm.

The Avene Dam. Situated on the Orb in Herault, this reserve of 33 million cu. meters is one of the works which allows irrigation in the Western perimeter

Horticultural Development

in the

Lower Rhône Valley

W. S. English

ALL countries concerned with horticultural development programmes are watching with great interest the efforts of the French to change and intensify the production of a huge area of the Languedoc plains of the Lower Rhône. The neighbouring departments of Vaucluse and Bouches du Rhône have, for at least a century, been important areas for the production of early vegetables and fruit but the Gard department has been mainly restricted to drought resistant crops such as vines and olives.

The Gard department with its centre at Nimes originally formed part of an old Roman settled state and was a direct route for the Roman legions proceeding from Rome to the Pyrenees. It is possibly for this reason that there is some resistance to change in spite of the economic problems which have arisen following a decline in the demand for common wine. This type of wine is the main production of the area, because, following the phylloxera crisis of the 1880s, replanting left the hills for the plains and the American rootstock on which the French vineyards were grafted proved to be highly productive and at present production far exceeds demand.

It is with this background that the regional development programme known as C.N.A.B.R.L. (Compagnie National d' Amenagement du Bas Rhone et du Languedoc) was established, beginning its work in 1955. The plan will involve the improvement of 625,000 acres of which 425,000 acres will be capable of irrigation.

The irrigation project

The lower Languedoc plains of the Mediterranean coast have excellent sunlight records with up to 2,700 hours per annum. Rainfall at 20–30 in. would seem to be sufficient but rain occurs on only 60–80 days each year and this mostly in the late autumn and early spring, and with such a high level of radiation in the summer, drought has always been a limiting factor. The temperature has a mean of over 6 degrees above France as a whole but it can be very cold in winter and wind, especially the very cold Mistral, is always a problem.

Irrigation of this huge area is made possible by diverting water from the Rhône and its coastal rivers by the construction of canals. On the east side of the Rhône the main canal north of Arles is 115 miles long and takes 2,800 cu. ft of water per second; the Western Zone involving 200,000 irrigatable acres uses storage dams with an aggregate capacity equal to 250,000 acre feet.

Previous irrigation projects, of which there have been a number in the past, have been based on the traditional furrow system but as this involves terracing and grading of the land and tends to create erosion, the present scheme will use sprinkler units over the whole area. This method, with its main network of underground mains will leave the land pattern unfrozen and allow for further land consolidation or re-grouping if necessary.

Water is delivered to the farmers by means of intakes carrying 1–4 taps each with a delivery rate of two thirds of a gallon per second. From these points small portable or semi-portable pipes lead to sprinklers that cover the whole cropping area. As the region is so subject to strong winds only a low pressure is maintained with a minimum of 28 lb per sq. in. at every sprinkler. A series of automatic hydraulic gate valves are placed in the main intake works and canals so that a full water supply is available at any time.

The cost to the users excluding the capital cost of the main distribution network is in the region of 6*d.* per 1,000 gallons.

Wind protection

Both older production areas and the new development are subject to strong winds and some form of protection is essential. The Mistral, a cold wind coming from the north down the Rhône Valley may blow at any time and is reported to blow on as many as 150 days of the year. Even winds from the south off the Mediterranean can be strong and dry enough to desiccate vegetables and fruit crops.

Shelter-belts cover most of the early production area and on the new farms these are the first consideration. A usual pattern is followed, the rows of conifers being about 150 ft apart and 700–1,000 ft long. The subjects are wind resistant types, almost invariably Cupressus, either *C. sempervirons pyramidalis* (Pyramidal Italian cypress) which is such a feature of the Mediterranean countries landscape or *C. sempervirons horizontalis*

which is more spreading and denser. As a disease has been found in some of these permanent hedges, *C. arizonica conica glauca* (Arizona Cypress) is now being planted as an alternative but as these are grafted they are rather more expensive. The trees are planted 3 ft apart and grow rapidly up to about 30 ft when they appear to grow only very slowly presumably due to mutual competition.

Cropping of irrigated land

The older developed areas to the east and west of the Gard and including an intensive area around Avignon are all furrow irrigated with fairly intensive shelter. Cropping is traditional with small family holdings still using some forms of hotbed for very early salads but growing a wide range of vegetable produce with little specialization. Many holdings in the proximity of large towns like Avignon are being taken over for house building and the compensated occupiers are re-investing in land further north where they are planting top fruit.

Protected cultivation

The constant threat of heavy cold winds and a high level of sunlight in the winter and early spring months attracts attention to any kind of protection. Plastic is obviously worthy of serious consideration and a real attempt is being made to exploit its possibilities. This was at its most spectacular in the Vaucluse area near Rousillon where plastic protected asparagus beds could be seen in every direction. The asparagus is cut through a slit in the film and a clod of earth used to seal the hole made.

Some of the local co-operative type organizations (S.I.C.A.) are very interested in extending plastic greenhouse structures. These are made up of standard units of a light steel framework covered with a nylon-re-inforced plastic film. Each unit is approximately 20 ft (6 metres) by 20 ft with a height of 8 ft (2·45 metres). These, which may be obtained on very favourable credit terms, may include heat exchange units with plastic ducting.

Tomatoes are the most favoured crop at the moment as March picking should be possible and this would possibly justify transport to consumer centres by air.

Problems of humidity control have not yet been wholly overcome but experience is being gained and a considerable expansion of this type of cropping is likely.

Some permanent glasshouses are being built but, as might be expected in a part of the O.E.E.C., the structures are mainly of a Dutch type with galvanized steel members and very frequently opaque glass. Crops in the permanent glasshouses appear to be aimed at supplying the luxury Paris market with flowers which include strelitzia freezia and roses, particularly the variety Baccara.

Food crops are mainly tomatoes, melons and aubergines and the Dutch influence in growing methods is clearly evident.

Vegetable cropping in the open

Shelter is again a problem. In addition to the traditional early salad crops and field crops of tomatoes for processing a great deal of interest is being shown in self-blanching celery. The crop which tends to be under-supplied at both ends of the British season would obviously be suitable for

the conditions available on the new farms. Importing interests in Britain are already making arrangements for extensive trials of varieties established in the home markets and a substantial production of this crop, particularly for harvesting in May and November, is a possibility.

Orchard planting

The availability of new farms and the return of many of the French North Africans has led to a very rapid increase in the acreage of fruit of all kinds. Peaches, both for processing and the fresh fruit market, dessert pears and most significantly apples have been widely planted. Most of the new plantings are varieties of American origin, the apple variety Golden Delicious being quite the most extensive, much of it destined for export to the rest of Europe particularly Britain and Western Germany. There is also an interest in finding a more highly coloured apple other than those at present grown which include Wilson June Red, Starking Delicious and Reine des Reinette.

With shelter being so important and irrigation necessary, intensive systems are practised and very high yields obtained.

Labour is not freely available except near the towns and much of the harvesting is done by itinerant Spanish workers.

Marketing

Estimates of new production of fruit and vegetables from this area have been put as high as 1,200,000 tons over the next 25 years and plans for the orderly marketing of such quantities have naturally received high priority.

In 1953 the French Government designated areas where new markets of national interest (Marchés d' Interêt National) should be established and as part of this plan a large market and storage centre has been completed at Nimes to serve much of the Lower Rhône area. This will finally be capable of handling up to 300,000 tons of fruit and vegetables per annum much of which is likely to find its way to importing countries of Europe.

The whole of the development of this most interesting area is being conducted in a spirit of great enthusiasm with substantial technical resources and much government assistance. Under these circumstances such a new and important production area with many natural advantages is likely to exert an increasing effect on markets throughout Europe and this may include the markets of Britain.

This article has been contributed by **W. S. English, N.D.H.,** who is Regional Horticultural Adviser for the National Agricultural Advisory Service in the South-West Region. Previous to taking up this appointment he was County Horticultural Adviser in East Sussex.

Remember the Bees!

Bees and other beneficial insects can be killed by the thoughtless use of insecticidal sprays.

In their own interests, farmers, fruit growers, spraying contractors and bee-keepers should co-operate closely to ensure that bees are protected from unnecessary dangers.

Close Company Distributions—

Some Practical Considerations

G. H. Camamile and E. S. Carter

BEFORE commencing a discussion about the practical problems likely to be involved in considering a company's distribution policy, it is important to look again at the precise words used by the Act. These are reproduced, almost word for word, in the Inland Revenue's own booklet, which reads, 'Where, in determining the required standard, the requirements of a company's business are taken into account, regard has to be had not only to the current requirements of the business but also to such other requirements as may be necessary or advisable for the maintenance and development of that business'.

Clearly, a company that is undertaking a programme of expansion, which has already taken considerable trade credit and is committed to reduce a bank overdraft which has not arisen as a result of borrowing to acquire initial assets, will experience no problems.

On the other hand, a company which is, in fact, saving up cash and can show a substantial balance of cash or investment in hand, retained for the purpose of purchasing additional land as soon as this becomes available, may have difficulty in assuring its local Inspector of Taxes that the purpose in saving the money is, in fact, to provide the deposit for additional land. This may be less difficult because, of course, credit for the purchase of land has not always been easy to obtain, and the Agricultural Mortgage Corporation, and most other lenders, require a purchaser to provide a deposit of at least a quarter of the cost of land purchased with vacant possession. Because farming is an industry which is capital intensive and in which the demand for improved buildings and new machinery grows year by year, even farming companies with substantial cash funds available may not find themselves faced with too great a pressure from the Inland Revenue to distribute.

The Inland Revenue may seek to suggest that in assessing a company's cash requirements not only the amount of the money which it has immediately available should be taken into account, but also the prospect

of income reasonably to be expected in the following year. This argument has already been advanced by the Inland Revenue in certain cases, but seems hardly appropriate in the case of farming companies, because of the special and uncertain nature of agricultural income.

The taxpayer must not be unreasonable in his expectations about what he hopes to persuade his Inspector of Taxes to believe. If a company has not, in fact, made any addition to its farming acreage or incurred substantial capital expenditure for many years, the Inspector will not be unfair if he views critically the argument that the company is saving up its cash to finance some nebulous scheme of expansion seven years in the future. Since, in the event the question would be settled finally by the local Commissioners or after them the Courts, the taxpayer cannot expect H.M. Inspector to give credence to a set of arguments which appear to be wholly theoretical, and do not have any foundation either in a special change in the company's circumstances or in the established practice of the company during its development over previous years.

Nevertheless, it was said by a Government spokesman during the debates on the Finance Bill 1965 that in the administration of the shortfall provisions the view of the Inland Revenue would not differ materially from that taken by the Special Commissioners in determining questions relating to surtax directions, and it is to be hoped that in the case of farming companies, the Inland Revenue will take a very reasonable view.

A very convenient procedure is available for obtaining clearance—that is to say, for obtaining an assurance that the Inspector of Taxes will not assess a company to income tax because there has been a shortfall for any particular accounting period.

A company may request such a clearance from the Inspector of Taxes, sending with its letter a copy of the accounts for the period in question, which must have been adopted by the company in a general meeting, and a copy of the directors' report, if any, for the period, and any other information which appears to be relevant. For example, the Inland Revenue's booklet suggests that it might be appropriate to indicate the factors which influenced the company's dividend policy.

The Inspector of Taxes may ask for further information, and he has a period of three months to request this. Either within three months of obtaining this further information or within three months of the original application, if no further information has been sought by the Inspector, he has to notify the company whether or not he proposes to make a shortfall assessment. Normally the procedure will probably be less formal than this, and when both taxpayer and the Inland Revenue have obtained more experience it is likely that the operation will, in the great majority of cases, be fairly straightforward.

Close Company Distribution—Requirements of the Business
'Agriculture' June, 1968 p. 276 para 2, line 6.

Clause 23 of the Finance Bill 1968 provides that any dividends which are declared in respect of the period and are paid during the period or within eighteen months after it are to be treated as distributions for that period. The reference above to a year should, therefore, be read as a reference to eighteen months.

A New Look at Grass Drying

John Jones

WHILST most authorities would agree that artificial drying is a much more effective method of conserving the nutrient content of the grass crop than either haymaking or ensilage, the fact remains that today relatively little herbage in Britain is processed in this way. High harvesting and drying costs no doubt had much to do with the decline from the annual peak production of 200,000 tons in 1952 to the present 100,000 tons. Then the average annual output of 1,000 driers was 200 tons; now 100 machines each produce about 1,000 tons. In looking to the future it is useful to consider events which influenced the decline from peak output.

Until de-rationing of concentrated feedingstuffs in the early 1950s, those farmers who had small driers were prepared to operate them expensively as this provided much needed unrationed home-grown supplements to their feed allocation. Later with the release of concentrates on to the free market, grass drying lost much of its attraction for small producers. The following are some of the more important factors which also influenced the decline:

(*a*) High drier operational costs. (Capital depreciation, labour, fuel, maintenance, etc.)

(*b*) A high labour requirement.

(*c*) Low crop yields—often involving a lot of work in harvesting and long hauls for each ton of dried product.

(*d*) Relatively poor quality herbage.

(*e*) Lack of a husbandry system to provide a succession of crops and a uniform flow of high-quality herbage to the drier.

(*f*) Weaknesses in feeding practice.

In practice economic efficiency in dried grass production is related to the costs of growing, harvesting and drying the crop and of processing the dried product. The size and throughput of the drying unit greatly influence drying costs. This partly explains why large modern plants are able to remain in business, whereas the smaller units of 1952 declined in numbers. The intervening years have brought a number of developments, not only in harvesting and drying, but also better grass crop husbandry and improvements in feeding practices.

Grass swards

Although there have been few outstanding additions to the range of herbage varieties that were available in 1952, there is now a better apprecia-

tion of their potentialities. It is now known how they respond to heavy dressings of fertilizers and what are the best times of cutting to produce the most rewarding yields of high-quality feed (digestible organic matter). From this it is possible to plan a succession of high-quality crops to feed the drier for more uniform production throughout the growing season.

Fertilizers

Today there is a greater appreciation of the responses to applications of fertilizers to grassland—particularly nitrogen—which are both possible and profitable. Quantities amounting to 350–400 units nitrogen, along with phosphates and potash, are not uncommon and could set the standard for future grass production for drying.

Field equipment

Modern high power tractors, better cutting and collecting machinery and transport wagons, have hastened harvesting and haulage and have reduced labour requirements. Chopping or double chopping of the herbage, which is incorporated into some of the newer harvesting machines, facilitates drying and subsequent processing.

Moreover, modern high output machines and large capacity wagons not only improve the speed of field operations, but also increase the acreage of high-yielding crops which can be harvested during a season, increase the length of the haul which is now practicable, permit the economic use of higher throughput driers and reduce labour.

Drying units

Some modern pneumatic driers produce two to three tons of dried grass per hour employing two men for each working shift. Former conveyor type machines would yield about 12 cwt hourly and required three or four men to operate them. The much smaller tray driers which previously were very common on farms produced only about 4 cwt of dried grass each hour. Throughput and labour efficiency therefore have both improved enormously during the intervening years.

Fuel usage and costs

Heavy fuel oil is consumed by modern pneumatic driers at rates varying between 60 and 100 gallons for each ton of dried grass. At say 10*d.* per gallon the fuel cost per ton of dried grass is 50*s.* to 83*s.*

While these costs are not very different from those ruling in 1952, the change from solid fuel to oil and automatic fuelling together have brought marked labour economies.

Feeding practice

To achieve full benefit from dried grass it must be fed according to its nutrient value. Supplied to the ruminant, either loose or from bales, it was often fed wastefully, both in regard to its nutrient content and with losses during handling. Feeding in the form of meal also was found to be unsatisfactory, both on account of its physical state and reduced digestibility which fine grinding seems to cause. Processing the chopped staple into wafers or

pellets offers prospects for overcoming these objections and should result in less wastage during handling and better control of the nutrient supply.

Perhaps this all-round progress which has been made during the past fifteen years or so is sufficient to justify the re-awakening interest in artificial drying which is now evident.

Present dried grass production is almost entirely used by compounders of pig and poultry feeds, and this market is saturated. Prospects for possible future expansion, it is suggested, should be considered in relation to:

1—the production of feed of suitable qualities and consistencies for feeding to ruminant animals;

2—the manufacture of products which, due to their general suitability, nutritional value and price are competitive with other feeds on the market;

3—the fuller use of grassland, efficiently integrated into farming systems on individual farms or on groups of farms.

Suitability of dried grass for ruminants

Artificial drying of young fresh grass leads to the production of high-quality feed having almost the same digestibility as that of the material from which it was made.

Dried grass quality assessments can be made for digestibility and crude protein content. For ruminant feeding these are adequate without the carotene estimations used for pig and poultry feeds.

High digestibility usually, though not always, results in high dry matter consumption and a correspondingly improved animal performance. For this reason it is important to maintain dried grass products at uniformly good quality levels.

To this end there is a strong case for planning a succession of crops coming for harvest at times when yields and digestibilities together produce the best total yield of nutrients. Moreover, a well-planned succession throughout the growing season materially assists economic management of the drying unit.

Digestibilities of first cuts of a number of grass varieties in pure stands can be predicted fairly accurately by reference to date of emergence of the grass head from its leaf sheath. Amongst the ryegrasses there is a variation of ear emergence dates from 42 to 78 days after 1st April. The last timothy emerges 94 days after 1st April. Hence with pure stands it is possible to arrange a convenient succession of cuts to coincide with quality and to produce grass of consistently high quality over a long period.

Whilst predictability is less certain for mixed swards and aftermaths, it is generally true that the younger grass has higher digestibility. Since reliable information about dried grass quality is essential for successful feeding practice, a method of rapid assessment and grading is needed by drying unit managers to enable them to supply it to feeders.

Fed alone finely-ground dried grass passes quickly through the digestive tract of ruminants and its feeding value for this class of animal is lower than if produced in long or coarsely chopped form. Handling is improved and wastage avoided when relatively coarse material is compressed into wafers or pellets.

Various classes of ruminant stock have different nutrient requirements and dried grass can be fed alone, along with hay or silage, or in wafer or

pellet form either for mixing with cereals or compounded with them, according to the needs of stock. If five pounds of good quality dried grass are reckoned as equivalent to four pounds dairy feed, then to replace the latter at, say, £30 per ton dried grass could be valued at about £24. There is evidence that dried grass can be produced for less than £20 a ton.

Organizational economy

Drying units today mill grass finely for compounders of pig and poultry feeds and benefit from the numerous economies of large-scale operations. Employing a small number of specialist operators throughout an extended grazing season, they are able to achieve economies in labour, overheads, transport and running costs of machinery and other equipment.

A high throughput of herbage as a means of spreading costs over a large tonnage of dried product is essential for economy of drier operations. Self-feeding mechanisms and automatic controls also greatly affect the efficiency of both large and small machines.

High yields of fresh grass from each acre, which are profitable in their own right, also assist running economy by reducing haulage distances and by helping to maintain the unit at full working capacity.

Compared with 1952 there have been many improvements in the design and efficiency of both field and drier machinery.

Large capital investment in large-scale units demands large acreages of grassland, and to economise in transport there are obvious advantages in placing the drying unit centrally.

A 500-acre land area with an output of 2,000–2,500 tons dried grass annually has high potential for economic efficiency though there may well be a good case for an acreage and output half this size. On this smaller acreage a machine producing 12–15 cwt dried grass hourly, might usefully serve three or four co-operating farmers maintaining between them 400–500 milking cows. Either case demands a high level of grassland management incorporating the use of the best herbage species and varieties, along with an annual fertilizer usage around 20–25 cwt per acre, including 350–400 units nitrogen.

As grass growth follows an irregular seasonal pattern advantage should be taken of varietal differences, production being stimulated during periods of depressed activity by the use of fertilizers. Supplementary crops like green cereals or lucerne can also be grown to cover periods when yields are low.

Besides reducing haulage, field wilting of the crop from 85 per cent to 70 per cent of moisture, it is claimed, will almost halve fuel consumption and where oil is used this can be as low as 50 gallons for each ton of grass produced. Other economies in fuel usage, including price concessions for large consignments, tend further to reduce drying costs.

For fine milling, moisture content is reduced to 5 per cent. Since fine milling reduces digestibility for ruminants and is not desirable, moisture can be raised to 12–15 per cent for wafers or other coarsely-chopped dried grass products. This 7–10 per cent saving in moisture extraction should bring further fuel economy.

Integration into farming systems

If drying installations of the future are to demand a minimum of 500 acres grassland, this means either that grass drying will only take place on large

farms or in areas where there are co-operators—either selling fresh grass, or in some cases buying back the dried product.

On stockless farms in some arable districts farmers already grow short leys for making into hay to sell. Here the grass break could be used for artificial drying, to provide a readily transportable product for a reasonable financial return, though with a sparse distribution of leys some long hauls would be likely. Lucerne, though requiring a good standard of general management, may yield 5 tons per acre dry matter and provide an additional profitable break from cereals. Moreover, a greater frequency of leys and lucerne cropping could prove beneficial to cereals and also help to concentrate herbage acreage into smaller compass leading to better economy of haulage to the drier.

In grassland districts where farms are on the small side and grass is both grown and consumed in the same area, there is scope for co-operative drying. But to reap the benefits of large-scale enterprise, avoiding uneconomic hauls of fresh grass, a high degree of co-operative participation amongst farmers in the vicinity of the drier is needed. Moreover, drying unit managers would need to have complete control of grass crops contracted to the co-operative group.

This article has been contributed by **John Jones, B.Sc., N.D.A.,** who is Regional Grassland Husbandry Adviser for the N.A.A.S. in the Yorks and Lancs Region.

A Common Market for Eggs and Egg Products

R. C. Rickard

THE E.E.C. is, to all intents and purposes, self-sufficient in eggs. Since 1962, when the market regulations were first introduced, consumption in each member state has been rising. Production, too, has been increasing especially in Federal Germany and Italy, countries which formerly imported eggs on a large scale. As a result, countries such as Denmark and also Eastern European countries, which used to rely heavily on markets in Community countries, have found that their deliveries have fallen. A similar trend has occurred within the E.E.C. and the Netherlands which, for instance, exported 3,000 million eggs annually in 1961 and 1962 but found its market reduced to 800 million in 1966.

It is claimed that the deterioration in trade between the Community and non-member states can be attributed to the restrictive nature of the E.E.C. market regulations. Indeed there is some evidence that production in the E.E.C. was stimulated by the larger marketing opportunities created by the common regulations. It must be remembered, however, that the expansion of poultry farming had begun before 1962. Furthermore, with the exception of Italy, where imports were free and the interests of domestic producers were completely disregarded, a wide range of protective measures already existed among member states before 1962. For instance, imports could be banned in Luxembourg. Minimum import prices could be applied in Belgium. France levied countervailing duties to balance out differences in market prices. In the Netherlands, levies were charged to offset differences in production costs caused by lower feed grain prices. In Germany, there were restrictions on quantities imported from certain countries and premiums were granted on eggs delivered to central packing stations. It could be asserted, therefore, that the regulations that first came into force on 1st August, 1962, were an attempt to reconcile these devious arrangements. In fact the transition period which lasted for almost five years saw the gradual phasing-out of the temporary arrangements with the Community.

The 1st July, 1967, marked an important stage in the common agricultural policy of the E.E.C. On that date, uniform Community prices for cereals were introduced and, because their prices depend largely on the prices of feed grains, a similar procedure was adopted for pigmeat, eggs and poultry which are known collectively as 'grain conversion' products. Levies on imports from non-member or 'third' countries as well as minimum import prices and restitution payments are now the same throughout the Community. The new regulations for pigs and pigmeat also contain provisions for market intervention designed to support producer prices, but no such provision is made for the withdrawal of eggs or egg products from the market.

The opinions which led the Commission to decide against a system of market intervention for eggs and egg products, appear to have been as follows. Firstly, they thought such a procedure would probably obstruct the trend towards a concentration of production in large units which is considered desirable. They also thought market intervention would encourage small producers to continue with fluctuating levels of production and would also tempt the larger industrial-type units to organize their production at selling prices approximating to the intervention price and, secondly, the free play of market forces within the Community would be the most effective means of ensuring that production is adjusted to meet the changing conditions of demand. Thirdly, they thought a major proportion of the costs of egg production are variable and subject to short-term fluctuations. It would, therefore, be extremely difficult to administer a system of support prices. Finally, they thought fluctuations in the price of eggs are influenced more by changes in demand than by variations in cost of production.

Although there is no official procedure for market intervention, the Commission recognizes that occasions may arise when direct action is required. Hence, in the egg regulations there are two safeguard clauses designed to prevent any severe disturbance of the market. The first gives the Commission the authority to prevent any undue and prolonged rise in egg prices in the Community. The other clause empowers the Commission

to intervene in the trade with third countries when the Community market is being disturbed by an excessively high volume of imports or exports.

The complexity of the E.E.C. regulations for eggs and egg products undoubtedly arises from the fact that a fairly wide range of products is involved. However, they all bear some relationship, direct or indirect, to the one basic product—the shell egg, fresh or preserved. For the purposes of this article, the illustrations given will relate to this basic product. There are three main features of the regulations—the levy system, minimum import prices and restitution payments. Each is dealt with separately below.

The levy system

The levy imposed at the common external frontier is the principal means of protection afforded to egg producers in the E.E.C. In a manner very similar to that employed in the pig regulations, the levy on shell eggs consists of two parts—a feed cost element and a 'fixed' element.

1. The feed cost element is equal to the difference in the cost, at E.E.C. and world market prices, of a prescribed quantity of a ration of certain feed grains needed to produce one kilogramme of shell eggs. The E.E.C. prices used are the arithmetic averages of the monthly threshold prices for maize, barley and oats for the year ending on 31st July. The world market prices are the arithmetic averages of prices, cost, insurance and freight Rotterdam, during the six months preceding the quarter in which the levy is fixed. In arriving at the total cost of each ration, the following weighting is used; maize 58 per cent, barley 29 per cent, and oats 13 per cent. The difference between the cost of the ration on Community and world markets is multiplied by 3, on the assumption that 3 kilogrammes of feedingstuffs are required to produce one kilogramme of shell eggs.
2. The 'fixed' element is an amount equivalent to 7 per cent of the average minimum import price during the year preceding 1st May.

The following example shows how the third country levy on shell eggs was determined for the period 1st July to 31st October, 1967.

		Per cwt
1.	Weighted average cost of the ration at E.E.C. cereal prices	38*s.* 7*d.*
2.	Weighted average cost of the ration at world market cereal prices	26*s.* 7*d.*
3.	Difference in cost of the rations	12*s.* 0*d.*
		Per dozen eggs
4.	Food cost (difference in cost of rations × 3 converted to a per dozen equivalent)	5·9*d.*
5.	*Plus* 7 per cent of minimum import price	2·5*d.*
	Third country levy	8·4*d.*

The levy is calculated for one year from 1st July. It can be altered at 1st November, 1st February and 1st May to incorporate changes in the prices of feed grains on world markets if there has been a change in the minimum import price at those dates.

Minimum import prices

The minimum import price system is a means of ensuring that eggs do not enter the Community at prices below a level considered to be a representative

cost of production in third countries. The levy system alone would not be sufficient to prevent the under-cutting of the Community's internal price level by imports at abnormally low prices. If the offer price falls below the prescribed minimum import price, the Commission may fix a supplementary levy to be added to the third country levy. This supplementary levy is the difference between the offer price and the minimum import price.

The minimum import price for shell eggs is determined in the following way. Firstly, the cost of a ration at world market prices is arrived at by employing the method used to calculate the levies. Secondly, an amount representing the tranport and unloading charges of cereals is added; this gives the total cost of the ration. Thirdly, an overall feed conversion factor of 3·62 : 1 is applied to the total cost of the ration. Finally, a further amount is added to cover other food and production costs. The result is an estimate of the cost of production of a given quantity of eggs in third countries.

The calculation involved in determining the minimum import price for shell eggs during the period 1st July to 31st October, 1967, was as follows:

	Per cwt
1. Weighted average price of cereals on world markets from November, 1966, to April, 1967	26*s.* 7*d.*
2. *Plus* transport and unloading charges	2*s.* 0*d.*
3. Cost of ration	28*s.* 7*d.*
	Per dozen eggs
4. Food cost (cost of ration × 3·62 and converted to a per dozen equivalent)	1*s.* 5*d.*
5. *Plus* allowance for other food and production costs	1*s.* 6¼*d.*
Minimum import price	2*s.* 11¼*d.*

During the current year the minimum import prices are effective from 1st July, but in subsequent years they will be calculated as from 1st August, each year, and reviewed at the beginning of November, February and May. An adjustment is made to the new minimum import price only if there has been a variation of 3 per cent or more in the feed grain prices used in calculating the minimum import prices for the previous quarter.

Restitution payments

Restitution payments, or export refunds, are to enable exporting member states to compete on world markets and not be at a disadvantage because of the higher cereal and other costs ruling in the Community. They are not intended to reduce the prices of exports from the E.E.C. below those on world markets and they are to be limited in total to the sum of the levies collected on any particular product.

In determining the amount of the restitution payments, many factors are taken into consideration—the present and anticipated future prices of eggs in the Community and on world markets; export prices from some non-member states to other third countries; production costs and the incidence of subsidies in those countries; the prices of imports into the Community; the difference in the E.E.C. and on world markets of a given quantity of feed grains needed to produce one kilogramme of shell eggs.

Such are the general criteria. The various methods currently in operation fall into several groups according to product. For shell eggs and hatching eggs, for example, the restitutions amount to an estimate of the difference between the most favourable import prices in third countries which are traditionally importers and, on the other hand, export prices in member states which are traditionally exporters. From 1st July, to 30th September, 1967, the restitutions on eggs out of shell and egg yolks were the same as the levies, but were subsequently reduced. It should be emphasized that a very wide range of alternatives is possible and the precise methods of calculating the restitutions can be, and frequently are, amended to suit the exigencies of any particular situation.

Quality standards

It should be obvious that uniform marketing standards for eggs are essential if a truly common market is to be achieved. The widely differing systems and designations employed in importing member states facilitates neither intra-Community trade nor trade between third countries and the E.E.C. With the purpose of remedying this undesirable state of affairs, a proposed regulation was drafted in early 1967 which was to be effective from 1st October, 1967. This was subsequently postponed and it is anticipated that it will now be 1st July, 1968.

The proposals refer to all eggs except direct 'ex farm' sales for human consumption of less than five dozen, hatching eggs, and eggs sent to breaking plants and intended for manufacture. Eggs, including those for industrial use must be consigned to a packing station, either direct or through a collecting point, with deliveries being at least twice a week. The packing stations are to be responsible for grading by quality and weight.

It is proposed that three quality categories grades A, B and C, be used, with eggs in the latter category being generally destined for manufacturing. Eggs in grades A and B are divided into seven classes by weight, and are to be stamped accordingly. Home-produced eggs in intra-Community trade must not be subject to any marking other than the compulsory quality and weight standards. They must not bear marks showing the country of origin, but supplies from third countries must indicate the source.

In the absence of any regular arrangements for direct intervention on the market, emphasis has been placed on the need to ensure that the volume of supply is adjusted to market requirements. The consumption of eggs in the Community is rising and it is believed that there is still plenty of scope for an increase in production. Measures have therefore been promoted to improve the organisation of production, processing and marketing. Efforts are also being made to improve the methods of collecting information on the trends in market prices and the development of statistical techniques to be used in short- and long-term forecasting.

The Commission has been given increased powers of control and inspection to ensure that the regulations are uniformly complied with throughout the Community and is also authorized to take steps to prevent or mitigate undue disturbances on the market. It remains to be seen how frequently these powers will be invoked. But, with rising production within the E.E.C., it seems fairly clear that the 'management' of the market will eventually become an important feature of the common market for eggs despite recent increases in consumption.

Mr. J. Holroyd of the Weed Research Organisation discusses the experiments carried out at Arthur Rickwood Experimental Farm for the control of weeds on Fenland soils

Weed Control on Fenland Soils

WEED control on Fenland soils is a specialized problem. The conditions under which both crops and weeds grow and herbicides work are exceptional. Fertility and moisture levels are generally high and the surface layers of the soil warm up rapidly in the spring. Growth, therefore, tends to be rapid and vigorous. The physical characteristics of the soil influence the activity of herbicides which act through the soil, primarily because the large amount of organic matter present reduces the effectiveness of many herbicides by adsorption. Results obtained on mineral soils cannot, therefore, be extrapolated to Fen soils with any degree of accuracy. There is thus an urgent need for more effective methods of chemical weed control.

The A.R.C. Weed Research Organization (W.R.O.) has conducted in the past few years a limited number of experiments on various aspects of weed control in the Fens. As a result of discussions between the Ministry of Agriculture, Fisheries and Food and the Agricultural Research Council it has been agreed to enlarge this programme. A small team has been set up for this purpose and will be under the control of the Evaluation Section of W.R.O. The objective is to develop methods for the control of weeds on highly organic soils in Britain of which the Fens form a large and productive proportion.

The early experiments were begun at the N.A.A.S. Arthur Rickwood Experimental Husbandry Farm (A.R.E.H.F.) and a large number of the experiments will continue to be performed there, with land and facilities kindly provided by A.R.E.H.F. In order to broaden the range of soils and other conditions under investigation a limited amount of additional experimentation will be conducted on ordinary commercial holdings with the willing collaboration of a number of Fenland farmers.

The primary objectives of the programme are:

1. To establish which of the soil-acting herbicides show a reasonable degree of activity against weeds growing on highly organic soils (in addition to those already known, such as linuron and chlorpropham) and then to evaluate any risks of damage to a range of crops common to the area. The

crops being examined this season include potato, sugar beet, celery, chicory, pea, onion, carrot, cauliflower and spring wheat. This should indicate possible selective uses for the more active compounds.

In this early phase of the work crops and weeds are generally kept separate to eliminate the complication of competition which, according to its intensity, can profoundly influence the size of the optimum selective dose of herbicide in any one situation; subsequent experiments with crops and weeds together will ensure that any treatments in which crop competition is essential for good weed control are not missed.

2. To obtain some indication of the magnitude of the variation in weed control performance by soil-acting herbicides under differing environmental conditions. Because this is part of a larger W.R.O. programme the herbicides are restricted to lenacil and linuron this season. The effectiveness of applications made on five separate occasions is being compared using two specially sown indicator plants. These two materials are either incorporated with the soil or left on the surface.

3. To investigate some of the factors which influence weed control performance such as soil moisture, herbicide formulation and distribution in the soil and 'accelerated mineralization' of the soil. This season these factors are being examined individually. Thus the weed control given by propachlor, linuron and chlorpropham is being compared when applied to (a) dry soil, (b) soil irrigated immediately before treatment, (c) dry soil irrigated immediately after treatment, (d) dry soil irrigated one week after treatment. In addition the weed control given by granular and wettable powder formulations of propachlor, both surface-applied and incorporated, is being compared. Finally it is hoped to try out the underground herbicide applicator, under investigation at the W.R.O. in another project, on highly organic soil.

4. To examine the persistence of herbicides in these soils. This season the persistence of linuron, fenuron and chlorpropham is being investigated, residues in the soil being measured by bioassay.

5. To establish the pattern of weed emergence on the Fens. It is often claimed that under Fenland conditions, post-emergence herbicides, with little residual activity in the soil, are relatively ineffective due to the successive flushes of weeds which may occur over a relatively long period. This work was begun by the Agronomy Section of W.R.O. and is being followed up in experiments on a number of sites this season.

An experimental officer (Mr. E. Ramand) and his scientific assistant (Mr. M. W. Moore) are spending most of their time on this programme and for the greater part of the spring and summer they will be based at the A.R.E.H.F. However, during the rest of the year they will be at W.R.O. headquarters near Oxford where all the facilities are available for supporting activities and experiments associated with this project. In this way it is hoped that research and commercial development and practice will proceed hand in hand towards finding answers to the weed problems on one of Britain's most fertile areas.

The Walford Smallholding

R. D. Park, *Principal, Shropshire Farm Institute*

WALFORD, The Shropshire Farm Institute, situated in the West Midlands, is by virtue of its geographic situation in the centre of a large variety of farming kinds. To the north there is the Cheshire Plain with its concentrations in dairying; to the east the classical arable farming of West Staffordshire and East Shropshire; to the south the stock raising areas running into the important cattle and sheep raising parts of Hereford; and to the west the uplands and fertile valleys of Wales. Throughout the whole there is a range of farms from those that are small and run by the family, to the very large units. At Walford, as a complementary unit to the teaching programme, and as a place for holding meetings and discussions for farmers there is a large mainly arable farm of 600 acres, and a smallholding, run on intensive dairying lines, of 36 acres.

The small farm situation

It would be easy, especially where there are many big farms, for us to concentrate on our bigger 600-acre unit. But it is, I suggest, at least as essential that we should be in business on a small place also. Small farms have always been important and will continue to be so. I say this from the point of view of them not only as starting off places and as an important and integral part in our social structure, but also as efficient businesses.

To narrow down my own definition of a small farm I would class it as being 'in lowland country and of an area within 20 to 100 acres'. On this basis it means that in England and Wales:

1. Out of every 100 holdings 59 are in the range of 20–100 acres.
2. Out of every 100 acres of land, small farms occupy 26 acres and these holdings produce 25 per cent of the national farm output.
3. Despite the general increase in herd size in recent years, 41 per cent of all dairy cows are kept in herds of less than 30 cows and the size average of all herds is only 26 cows. These facts emphasize the important contribution to our milk supply made by the small producer.

A commercial venture

Since its establishment in 1952 the Walford Smallholding in its albeit brief history has reflected the changes in economic structure and production processes to which small farms are so very sensitive. Throughout this time our smallholding has been run strictly as a commercial venture. The evolution of the farming policy for this holding is in fact one which has attempted to match the demands of economic change and development.

A start was made in 1952 with a cowshed for 16 milkers together with ancillary boxes; fields were divided to give a rotation of crops including a few roots. For a period traditional varieties of enterprises were followed. In their turn small-scale poultry keeping and a few pigs were discontinued. Over ten years ago the cash roots and grain growing were finished with as part of the farming enterprise. A system of dairying was, and continues to be, the paramount venture and, whereas until 1959 heifer calves for herd replacements were reared on the farm, from that date a flying herd has been carried.

Unquestionably as time went by the maintenance of trading profits became increasingly difficult. Without doubt too, each time the policy changed towards simplification the net farm income took an upward turn.

1959–64

This was a period of specialist milk production. Apart from some kale and Italian ryegrass the whole of the 36 acres was in long ley. A few home-reared heifers were still coming into the herd in the early part of the period; later good type commercial newly-calved heifers were bought as required. Strip grazing was practised with hay and silage being made on the farm. A usual stocking rate was 28 cows and heifers in milk or dry in calf.

Intensification 1964

It became abundantly plain during 1963 that profits were falling. Here, of course, our assessment of the situation was not made in isolation and selfishly with only our own smallholding in mind. We recognized that others must have the same problem and indeed may be feeling the effects more than ourselves.

What could we do about it?

1. To enlarge the present holding from 36 to 50 acres by including part of an adjoining field belonging to the main farm and to increase the cow numbers to 40?
2. To remain as at present but to incur some capital expenditure to cut labour costs?
3. To change from dairying to another enterprise or other enterprises?
4. To add another enterprise and additional labour?
5. To increase the stocking rate from the present 28 to 40 cows on the existing 36 acres?
6. Let someone else have it?

There may well have been other alternatives; but although we have taken one line of action these other possibilities were open to us.

Finally, we decided to embark upon a plan which commended itself as a logical successor to our decisions in earlier years; to intensify and to increase the size of the business on a fixed acreage.

Organization of production factors

The development plan upon which we started in late 1963, was one of intensification. Simple though affairs may have seemed to be on such a small place, it is, I think, remarkable to recognize all the possibilities there may be when one sets about preparing a detailed analysis of the situation. How many cows to keep and what breed? How best to utilize the land–grazing, hay, silage, or whether to conserve grass at all? Winter or summer milk? Housing? Milking arrangements and the demands on labour, and the human factor? At this point let me discuss the factors as they were seen when forming our plan of organization.

High stocking density

Within reasonable limits we must accept the fact that on a given acreage the greater the number of producing units kept the greater is the gross output and the opportunity of total profit is enhanced. This lesson was made quite clear in the earlier years of development of our smallholding.

As a separate reference, the Ministry of Agriculture, Fisheries and Food publication *Farm as a Business series, Aids to Management No. 8. Dairying (2nd Edition)*, is an excellent presentation of figures in reply to the question 'A farmer with a herd of 40 cows buys in all his replacements at an average price of £95 a head. Would it pay him better to rear his own replacements?' The reply given in this booklet is a convincing case in favour of not rearing.

We finally settled, as from October 1964, to keep 40 cows and no young stock. Then in October 1965 we started off with 50 cows and no young stock, and at present we are running with 55–60 cows.

Grassland policy

Our objectives with grass are direct and simple. The whole of the grass production is grazed by the dairy herd. No deliberate attempts are made to conserve hay or silage except that periodical surpluses may be tackled as hay. The recognition is that there is no cheaper food for the production of milk than grass grazed; grass conserved is a very different matter. Being on good and fertile land, as indeed are many other dairy farmers, we rely on long leys, either based on varieties of perennial ryegrass or on recognized blends of timothy, meadow fescue, and white clover. The importance of having leafy strains of grass cannot be over emphasized.

Under the best of conditions and on this good land especially in favourable seasons, it is not unrealistic to aim at keeping two milk cows to the acre for a large part of the grazing season. It is a good target. Of course, if one expected to achieve a continuous stocking rate such as this then well nigh the impossible is being asked for.

All of our grazing during the last three years has been managed on the paddock grazing system—dividing the whole of the allocated area of grassland available into 21 paddocks, each approximately equal in size. Admittedly in the flush period of growth in the spring it was not possible to fully utilize the whole of the grazing set aside. And in the closing stages of the summer

and early autumn the target of two cows per acre was not achieved. But on average the stock carrying performance was up to target. All of this means that in 1965 and 1966 we had a few acres of grass surplus to our grazing requirements and this had to be conserved. That in itself created a problem. From my own observations I have found that a small area can be grazed, just in the one day, so enabling the herd quickly to defoliate the grass without waste and without repeated treading. This constant quality of grazing from day to day leads to a good level output of milk production without the fluctuations inherent in systems tied to extensive grazing or even by the use of strip grazing.

Immediately after grazing any nitrogenous top-dressing can be applied, as the cows will have moved on to the next paddock. A system of paddock grazing lends itself to routine. The cows know what to expect and the operator, having once put up the fences, has no other fencing that needs attention. Simple and workable routines are always a benefit in handling livestock.

The regularity of moving on from one paddock to another in itself avoids dangers of over-grazing which so quickly leads to exposure to the sun and wind drying out and delayed recovery of the herbage.

Winter feeding on products of arable farming

The plans for winter feeding on our smallholding are based on the fact that, with our limited acres, winter fodder is cheaper to purchase than to grow ourselves. Certainly I am not critical of the value of silage or hay, provided there are sufficient acres to set aside for these crops. But our stocking is now geared to the winter housing available and to our ability to effectively exploit the summer grazing. We have, so far, not reached the limit of intensification.

A little hay is made annually but this is really incidental to the summer management of the grass. Based on our earlier experience with another herd at Walford we continue with various rations of a concentrated kind supplemented with barley straw to provide maintenance, or at best maintenance plus the first gallon of milk. Purchased compound concentrates are fed additionally for production in the winter time. Diets, of course, may vary, but in general straw balancer feeding systems replace about 20 lb of hay or 60–70 lb of silage with 10–12 lb barley straw and 6–8 lb barley meal and straw balancer, depending on the particular brand of product involved.

Performance of cows

We have always had Ayrshire cows on this smallholding. They have been purchased locally and commercially on a visual assessment of body capacity, suitability of udder and correctness of the hind leg. Whenever possible any available records are considered. Prices paid have reached £85 each for calving heifers. We maintain comprehensive records, and the following selection of details illustrate the effect on output per acre following further intensification of stocking rates during the last two years.

	1964–65	1966–67
Farm size (33 forage acres)	36	36
Average herd size	40	54
Stocking rate (acres per cow)	0·9	0·66
Milk sold per cow (gall.)	883	851
Milk sales over feed and fertilizer costs/acre (£)	81	105

During each of the last three years 2·5 lb compound dairy nuts have been fed per gallon of milk produced and the utilized starch equivalent obtained per acre of grass is 25 cwt.

Some of the questions asked

It is not possible for me to record the number of visitors we have, but annually I estimate that we receive about 5,000 farmers asking questions about our smallholding. We have enjoyed them coming. Perhaps to set out some of the questions asked may be of interest:

Would we not do better with home-reared cattle?

What is the fertilizer policy?

Are there any problems with cows getting in-calf?

What is the value of calves? What bull to use?

What would happen if everyone did this?

What is the purchase price of heifers and value of barrens?

The suitability of tetraploid grasses.

System of winter housing. Loose housing, cubicles, kennels.

What happens in a very wet spring—treading of pastures?

What is the possibility of vacuum silage for grass surpluses?

The method of disposal of farmyard manure.

What are the capital costs? How do you phase expenditure?

Can the system stand a long winter?

What would happen in a drought?

What is the system of record-keeping for cow management?

The human problem—keeping on top of the job.

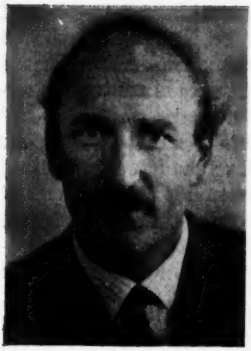
I still feel that our smallholding must continue to be looked upon as a test bench and not as a final blue print which can adequately answer these questions and others. Nevertheless, reliable progress seems to be continuing.

This article has been contributed by **R. D. Park, B.Sc., N.D.A., N.D.D.,** who is Principal of the Shropshire Farm Institute at Walford, Baschurch, Shrewsbury.

'Agriculture'

Earlier Publication

As from this issue the journal will be published at the beginning of the month instead of towards the end of the month



B. Wilkinson

Land Capability

Has it a place in agriculture?

IT IS important for the individual farmer to know his land and in considerably more detail than is required for broad planning decisions.

Do farmers know the capability of their land? Are agricultural advisers acquainted with the full potential of the land within their area? The concise answer to these questions is—very few! The outlook of many farmers and advisers is often coloured by existing land use and their assessment tends to be essentially 'parochial' rather than national. What advantages would the knowledge of land capability bestow?—this is the obvious retort to the initial questions. Let one reflect on the following facts: farms are changing hands at an increasing rate; under contemporary economic conditions, farming systems are more fluid than possibly at any time in history; and farmers everywhere are looking for ways of increasing output or lowering costs through changes in cropping programmes or farm enterprises. To facilitate these farm reorganizations all available resources, including that important physical resource the land, must be examined and utilized to the fullest extent. Pressing land beyond its capability however can spell trouble. If computers are employed as an aid at this planning stage then their 'diet' comprises facts and figures—not old generalities. In essence, reliable data is paramount for reliable farm planning.

Purpose

The object of a land capability classification is to provide the physical information concerning a farm's land resources in a systematic, factual and yet acceptable form. Information on variations in land quality on the farm, how soil attributes can be harnessed, and how defects can be overcome or are limiting would be provided. The degree of flexibility allowed in respect of cropping would also be covered, together with estimates of expected yields at

particular levels of management. This improved physical land data, blended with other essential information on husbandry and business aspects should allow for clearer management decisions. Good management decisions based on a thorough understanding of the land on the farm, should assist an enterprise to succeed—the recollection of the adage 'Forewarned is forearmed' seems appropriate in this context. Land capability data to satisfy this purpose must be capable of application at the farm and field level but more generalized presentations, which can be utilized for local and national land use work and for educational purposes, are catered for within the classification scheme. An important point to stress here is that a land classification capable of application at the farm and field level can invariably be processed into a less detailed form but the converse is not the case.

Land can be classified in a number of ways depending on the objective of the classification. The concept of land capability was first developed in the United States some 20–30 years ago in response to the need for the systematic interpretation of land characteristics for advisory purposes and for applying soil conservation measures on farms following a study of soil erosion. An assessment of land potential, rather than existing use, together with the soil and the management requirements of the common agricultural crops, including grassland, are basic to the scheme. Initially, in the United States a major impetus for land capability work was created by the urgency of controlling soil erosion. Whilst this is still a major consideration, the use of the land capability concept has been extended to cover farm planning advice, rural community needs and multi-purpose land use work. Indeed the Soil Conservation Service offers a service to farmers whereby on request the soil scientists will prepare a land capability map of a farm.

Presentation and organization

The components of land, comprise soil, climatic and site factors which interact to variable degrees to create the quality of land at any specific place. The communication of these concepts by soil scientists to agriculturists and farmers has raised difficulties; at times there has been a complete failure in communication through the use of technical jargon. The land capability approach attempts to surmount the communication problem by presenting reliable predictions and facts about the behaviour of soils under defined conditions. It involves a process of interpretation and rationalization and indicates reasonable alternatives concerning the use, management and expected results for each soil. It is self evident that the more precise the data available the more reliable are the predictions or interpretations. A careful synthesis is attempted of (1) basic soil data obtained from field and laboratory research, (2) data from field experiments and surveys and (3) the experience of users of the soils. This necessitates the co-operation of advisers, farmers, meteorologists, research workers and soil surveyors. Inter-discipline co-operation on projects of this kind could profitably be stimulated and encouraged in this country. Only relatively permanent physical land features are utilized, covering such characters as (1) soil factors like texture, depth, drainage, stoniness, (2) topographical factors like slope and height and (3) climatic factors such as temperature and rainfall. In situations where, for instance, soil nutrient deficiencies or land improvements like drainage, flood prevention or irrigation, are capable of economic rectification, then the land is classified according to the remaining limitations as if the improvement had

been accomplished. The classification is also essentially dynamic and periodic revision will be needed at possibly intervals of 5–10 years. These revisions are required to keep abreast of advances in technology, land improvement measures, or deleterious effects of mineral extractions from the land or industrial pollution. Science acknowledges the imperfections in contemporary knowledge and concedes the need for re-interpretations in the light of new discoveries.

The land capability classification is presented through three groupings, namely classes, sub-classes and units.

Capability classes

There are eight capability classes of land each strictly defined. At the top of the scale with no or very minor limitations, Class I includes the highest quality land consisting of deep, well-drained, light to medium loams on level or nearly level sites and capable of very intensive cropping. Examples of such land are to be found on the light silt loams and brick earths near the East Coast or certain sandy loams with a water-table within root range in the Vale of York. At the other end of the scale, Class VIII land has the severest limitations to use, resulting from one or more of the following reasons: harsh climate, thin stony soil, very steep slopes or water-logged conditions, for example, certain land in our mountainous areas which is consequently only suitable for recreation and water-gathering.

The Classes are thus graded according to the *relative degree* of limitations from the highest cropping potential.

Capability Sub-classes

The sub-classes indicate the major kind of limitations to which particular soils may be subject.

Four sub-classes are recognized, namely:

r —relief
w—excess water
s —root zone limitations
c —climatic limitations

Capability units

These comprise groups of soil survey mapping units having similar potentials and limitations. These soils are sufficiently uniform physically to maintain similar crops, require similar management and possess comparable productivity.

To summarize, the capability class presents only general information for agricultural use or national planning, the capability sub-class indicates the kind of limitations involved and provides information for broad farm planning, whilst the capability unit provides information for use at the individual field and farm level.

Land capability classifications are usually presented in map form accompanied by a legend amplifying the groupings in detail.

Specific studies

For any district, the classification of land capability groupings necessitates a specific study project, ranging over a number of years, to accumulate the essential data. The projects are also limited to areas which have been soil

Range of land capability classes in the Vale of the White Horse

surveyed and ideally the soil survey and the land classification project should be synchronized. Although this appears restrictive, if important key agricultural areas where covered initially, the date could be applied over wider unsurveyed areas where similar soils exist. The key organizations capable of undertaking the essential field work are the N.A.A.S., co-ordinated by the soil scientists, and the Soil Survey of England and Wales, whilst research workers could be encouraged to co-operate by investigating in the laboratory and the field the fundamental characteristics of soils from a project area. Little progress has been made on detailed classifications but a pilot project commenced in 1964 in the Vale of the White Horse, Berkshire, and it is intended to initiate a similar scheme on the Melton Mowbray Sheet (part of Nottinghamshire and Leicestershire) in 1967. A land capability classification of the Church Stretton area of Shropshire has also been published. The concept is also being increasingly utilized for particular advisory purposes such as a silt land project, Lincolnshire.

An illustration of the land capabilities within the Vale of the White Horse, Berkshire, is given on p. 347. A fact immediately noticeable is that the soil within a single mapping unit may straddle more than one land capability class. This is due to significant soil, site or climatic variations, such as soil depth, drainage, rainfall or slope, in some cases over relatively short distances. Identical soils found on a level site or on a steep slope obviously have different potentials because of the difficulties of farming one compared with the other. Similarly a heavy soil in a low-lying situation receiving drainage water from adjoining higher land and having no satisfactory outlet for the water must have a lower capability than the same soil in a better drained position. Variations of this kind occur more frequently in this country than in many areas of the United States for instance; consequently special problems are introduced when applying the scheme under our conditions.

Tentative land capability classification

Vale of the White Horse, Berkshire

Soil mapping unit	*Capability class*	*Sub-class*		
Icknield	III	s.		c.
(*a*) Steep slopes	VI and VII		r.	
Wantage	II		s.	
Harwell	I			s.
Challow	III IV	w.		s.
Marcham	III		s.	
Fyfield	III		s.	
(*a*) with irrigation	II			

Uses

Land capability data should find a ready application in farm planning and technical advisory work. More systematic data on a farm's land resources and on the technical consequences of particular cropping alternatives permits a more logical discussion of possible plans. Again if linear programming were contemplated, then the specific land facts would contribute to more reliable forecasts. Land capability classification would be especially valuable where a farm had recently changed hands or for an agricultural adviser newly transferred to a region, because documented information would be immediately at hand for consultation. At the national level a systematic inventory of land resources could also be compiled to assist decisions on the agricultural aspects of planning applications or the preparation of economic plans. Extensions into the field of multi-purpose land use can readily be envisaged and has indeed progressed far in the United States. The very commitment of knowledge about our land to record and publication, would constitute a remarkable gain. Technical progress and structural changes in farming continue at an ever-increasing pace and in the transitional stage land capability data must find a ready application. The late Sir Dudley Stamp is reported to have remarked that Britain knew less about her land than most advanced countries—'We cannot budget until we know what we've got'. If this indictment is true then land capability has indeed a vital part to play in reconciling the needs of agriculture on this crowded island.

This article has been contributed by **B. Wilkinson, B.Sc., M.Sc., Dip. Agric. Chem. (Leeds)**, who is Soil Scientist for N.A.A.S. in the East Midland Region. Previous to taking up this appointment he was Soil Scientist in the Newcastle and Reading Regions.

He has made a special study of land capability and was a member of the A.L.S. Study Group on land classification.

Sir William Gavin, Kt.,C.B.E.

An appreciation of the late Sir William Gavin will appear in the August issue of *Agriculture*

13. Denbighshire

T. M. Telford

At a recent demonstration held at Llangwyfan Farm, Denbigh, many farmers were able to see the two suckled calf systems which Mr. H. C. Hughes is practising. This farm of 335 acres was a dairy farm until 1962, with a herd of 52 Friesian cows. Approximately 100 acres of the farm is flat, another 100 acres rises to between 500 and 600 feet, and the remainder is mountain land, rising to about 800 feet. Since 1962, two separate suckling herds have been built up. Some of the Friesian dairy cows were crossed with an Aberdeen Angus bull to produce single suckling cows for keeping on the mountain land for most of the year. Some of the cows in this herd, which now numbers 25, are in fact from a second cross with the Angus bull. All of these are crossed with a Hereford bull and until recently calvings have been in January and February. Since the demand is now for a heavier calf, future policy will be to calve before Christmas. Last year's calves weighed an average of 5 cwt on 20th July. They were weaned in early August and fed concentrates on good aftermath grass until selling time.

The other herd now numbers 30 Friesian cows, which are double suckled and they use the lower land for part of the year. This herd is mated to a Hereford bull and calvings are concentrated in October and November. All heifer calves and any poor male calves are sold and replaced with strong Hereford Friesian cross-steer calves. Each cow suckles two calves, and they are housed in small loose boxes during the winter with a maximum of six calves per box. The cows are brought into the boxes twice per day for feeding. The policy now is to wean the calves at the end of April, when they go out to grass. This ensures that the cows are in excellent condition for calving in the early autumn and no trouble has been experienced in drying them off, although antibiotics are used. Concentrate feeding of the cows during the winter is fairly generous and hay and concentrates are also available for the calves. Farmers attending the demonstration were most impressed by the appearance of these calves, which averaged 6¼ cwt on 20th July and had gained 2·4 lb per day from birth. They were an extremely level bunch and, when sold in early October, actually weighed 7 cwt per head on average and would not take very long to finish.

Financial results for the two herds for 1966 are as follows:

Single suckling

Variable costs per cow	£	*s.*	*Gross output per cow*	£	*s.*
Hay	2	10	1 Calf	44	0
Grazing	3	10	Calf subsidy	9	6
Concentrates (including calf food)	8	13	Hill cow subsidy	18	0
Depreciation	5	10			
	20	3		71	6
Gross margin per cow:	£51	3	Gross margin per acre:	£20	8

Double suckling

Variable costs per cow	£	*s.*	*Gross output per cow*	£	*s.*
Hay	3	15	Calf sales:		
Grazing	7	0	2 @ £65 5*s.*	130	10
Concentrates	25	10	Calf subsidy:		
Calf food	8	0	2 @ £10 5*s.*	20	10
Depreciation	5	0	Beef cow subsidy	6	10
Vet	1	0		157	10
			Deduct: Purchase of extra calves and share of heifers sold	41	0
	50	5		116	10
Gross margin per cow:	£66	5	Gross margin per acre:	£26	12

In comparing results of the two systems, we should note the main points of difference. Single suckling is a low cost system, making use of poorer land, and where the cows are housed during the winter this must not be expensive. Double suckling, on the other hand, gives a much higher output per cow; to achieve this a much higher level of concentrate feeding is needed and housing of the cows and calves is necessary during the winter. Early calving is essential with both systems. To achieve a reasonable profit, the gross margin per cow must be as high as possible with both systems, but good grassland management is also necessary so that the cows and calves can be kept on the smallest possible acreage, thus ensuring a margin per acre which will adequately cover the fixed costs of the farm and leave a satisfactory profit.

The Ministry's Bulletin No. 154, *Grass and Grassland* describes the production and upkeep of grassland, the best use to make of it and the profits that can be expected from it. Copies may be obtained from Her Majesty's Stationery Office, P.O. Box 569, London, S.E.1., Government Bookshops and booksellers, price 8*s.* (by post 8*s.* 7*d.*).

FROM THE ALS

This short article pinpoints some measures that can be taken to safeguard farm buildings and livestock against lightning damage

Protection against Lightning Damage

M. J. G. Roberts, *Agricultural Land Service, Oxford*

Less than one thousandth of a second is enough for a stroke of midsummer lightning to shatter a building, fissure a tree or 'bushburn' a human being. In Britain some ten people die annually from lightning. Contrary to popular belief, a number of people have been filigreed with lightning burns and lived. About one stroke of lightning falls on every 100 acres each year. The trend is for the storm frequency to decrease from east to west and from south to north. Thus, parts of East Anglia and the Chilterns average as much as 18–21 thunderstorm days per year while parts of Pembrokeshire and Northern Scotland receive as little as three.

Essentially, a lightning stroke consists of a series of incandescent streaks of electricity, breaking out from a cloud as filaments with the speed of light at 186,000 miles a second. What is known as a 'leader' stroke develops in a highly charged part of a cloud and flows out either to another cloud or earthwards. A charge called a 'streamer' builds up in the earth and may start away from a prominent point, such as a spire, striking up towards the cloud along the path of the leader. It is this 'return stroke' which carries the heavy current.

Whether a building should be protected against lightning is ultimately a question of cost. Complete protection is possible; but the question is whether the burden of taking adequate precautions is warranted by the probability of risk and the loss which will result if the building is struck.

To assess the need for providing protection a risk index has been developed. Points are given for each of the variable factors which have to be taken into account. A high points rating shows the need for a lightning conductor. Thus, a building thatched with straw or reeds, or in which very combustible material, such as fodder, is to be stored, will merit high risk index points, whereas an all steel structure needs no special protection. Reinforced concrete framed buildings of ordinary farm size should be safe; exceptionally large ones can be fitted with a conductor.

Besides local topographical features and the incidence of thunderstorms, it is relevant to consider the type of building, its height above ground level and the use to which it will be put. Chimneys that are free standing or project more than 15 ft above their surroundings are especially dangerous. There is no protection against the very high temperature associated with lightning which induces a strong blast of superheated air capable of lifting tiles and slates and dislodging masonry.

There are three main parts of a lightning protective system. Uppermost, an 'air termination' which is often a single vertical conductor, intercepts the discharge of lightning and leads it by way of a 'down conductor' to the 'earth termination' or earth termination network. This lower part may consist of a 4 ft hard drawn copper rod of $\frac{1}{2}$ in. diameter or phosphor bronze rod for hard ground, buried in the soil. A more expensive alternative is to use a 3 ft square copper plate about $\frac{1}{16}$ of an inch thick. The earth termination operates to discharge the lightning current into the ground where it is neutralized by earth electricity.

Copper is the most suitable material for lightning conductors, being soft, durable, resistant to corrosion and a good conductor of electricity. Aluminium and, exceptionally, galvanized mild steel wire are also used. Strip copper at least $\frac{3}{4}$ in. by $\frac{1}{8}$ in. can be used for both the air termination tip and the down conductor. An inadequate lightning conductor which cannot contain the electricity passing through it could split the walls of the building to which it is fastened.

Periodic inspection of the protective system should be included with other routine farm maintenance. Faulty joints, contact with incompatible metals and atmospheric corrosion need to be guarded against; copper attracts thieves as well as lightning.

Metal pale fencing can be a source of lightning danger and fences for safety should not exceed about 75 yards without a wooden gate or 3 ft gap filled with some non-conducting material. Each section needs to have an earth termination set at least 25 ft from a gap.

Sometimes it is desirable to protect trees for historical or amenity reasons, also to protect nearby structures since there may be a side flash causing physical damage or fire if a tree taller than a structure is struck. Protection consists of leading the down conductor from the top of the stem or protruding upper branches along the trunk and connecting it to two earthed rods on opposite sides of the tree. The roots are encircled by a strip conductor at a 50-ft diameter from the trunk.

Animals are much more susceptible to electricity than human beings. As they tend to congregate near fences or under trees they are very much safer indoors than out.

It is said that lightning never strikes in the same place twice. But when it unfortunately does strike damage and loss can be considerable. This short article points to some of the measures which can be taken to safeguard property and stock. It is desirable, however, also to ensure that there is adequate insurance cover against it.

in brief

- **Pasture change for calves in July**
- **Plastic house for calves at Newton Rigg**
- **Knaptoft: Dairy centre**

Pasture change for calves in July

WHEN Dr. J. F. Michel, of the Central Veterinary Laboratory, Weybridge, addressed the British Grassland Society earlier this year, he pointed to the grazing hazard to which a great many calves are exposed every summer. In a word—worms. Only two of the half dozen species of nematodes which parasitize the gastro-intestinal tract are really serious threats to the growth rate of calves. They are known to the parasitologist as *Ostertagia ostertagi* and, of less significance, *Cooperia oncophora*. This danger, claimed Dr. Michel, can largely be averted if the young cattle are moved on to clean pasture in mid-July and given adequate anthelmintic treatment at the same time.

This advice stems from very careful experiments at Weybridge and other (widely separated) centres in England over the past three years, 1965–67, including an examination of what might be called epidemiological first causes since 1958. The parasites do not multiply within the host, but from the worm eggs voided in the dung. The process of egg development and migration from the faeces to the herbage, extended in the spring, gets quicker as the season advances, reaching a minimum of two to three weeks in June. Therefore contamination of the pasture by calves which have become lightly infected in spring by larvae overwintering on the pasture does not produce a dangerous infestation on the pasture until July.

Thus if such calves are moved in mid-July to pasture which has not been grazed by cattle since the winter, they will avoid this large disease-producing generation of the parasites.

Dosing with anthelmintic at the time of the move is a safeguard against subsequent infection arising on the clean pasture from worm eggs dropped in July and August.

The suggested control measures depend, of course, on there not being any marked divergence from the seasonal pattern of herbage infestation, but experience so far has not suggested that the range of variation from region to region and from year to year is anything other than slight.

Fitting the idea of a July grazing change for calves into existing grassland management should not raise too great a difficulty. 'In effect,' said Dr. Michel, 'the suggested procedures demand only that ground grazed by calves until mid-July shall not be grazed by them after that time and that sufficient pasture not grazed by cattle since the winter shall be available for the calves after the middle of July. Since the pasture occupied by calves in the first half of the grazing season can subsequently be grazed by older cattle—i.e., cattle in their second or subsequent grazing year, or by other stock—and since aftermaths, either after one cut of hay or two of silage, are likely to be available in mid-July, it should be possible to implement the suggested measures on most farms'.

Bearing in mind that the estimated annual loss attributable to worm infection of calves has been put at £2 million, Dr. Michel's recommendation is certainly worth trying.

Plastic house for calves at Newton Rigg

The idea of plastic housing as a cheap and adaptable form of protection for livestock is obviously attractive. The fear is how well will it stand up to the elements? Reports of total wreck by gale-force winds have made the news columns of the farming press, largely no doubt because of their ingredient of drama. But others, less publicized, have successfully 'weathered the storm' and have done a good job at an extremely economic figure. Not the least of such examples is the 40 ft × 20 ft house which the Cumberland and Westmorland College of Agriculture erected on their Sewborwens Farm, Newton Rigg, for calf rearing last year.

This was a semi-circular building (10 ft to the ridge), the framework of which consisted of a hooped, tubular-steel scaffolding, bolted together at the ridge and anchored to the ground with steel pegs. The whole structure was covered by 1,000 gauge, clear plastic sheeting from 2 ft from the ground to within 1 ft either side of the centre of the ridge, thus allowing natural ventilation. The lower 2 ft of the sides of the house was built up with straw bales. The plastic sheeting was lined with nylon net, between which loose straw was filled in to avoid condensation. Both ends of the building were then built up with straw bales, and the interior given a central feeding passage with pens made of straw bales along each side. The straw components will naturally be disposed of and renewed with fresh materials each year.

At a cost of £40 or so for the frame structure and sheeting, the seventy calves reared successively since November has more than justified the Principal, Mr. W. Steele's decision to adopt this type of housing.

Although plastic type housing, when well erected, has proved to stand up to very strong winds in the north of England, it seems only to be a reasonable precaution to site it in as sheltered position as possible and to orientate it out of the direction of the prevailing wind. The fire hazard should not be greater than with other buildings where fodder and bedding is to be found.

Knaptoft: Dairy centre

At a time when dairy farmers are feeling their way towards bigger business and more cows to the acre, the news that B.O.C.M. will be opening a new dairy centre in Leicestershire comes opportunely. This will be at Hall Farm, Knaptoft, about half way between Market Harborough and Leicester, and will supersede the cattle section at present at Barlby. Overall management will be in the hands of Mr. Pat Bichan, and the day-to-day management under Mr. Jim Anderson.

On the farm's 340 acres the project is to carry some 300 milking cows, plus followers, managed for high yields at a high level of efficiency in terms of both intensive use of grass and feeding for high yields during the winter. The cows will be split into five separate herds, each fed and managed under a different system, and they will be individually costed, but all 300 will be brought together and milked through a central herring-bone parlour.

At present Knaptoft is a typically large arable unit with few and very traditional buildings, so that the way is open for a modern approach to good housing, food storage and handling. 'But', says B.O.C.M., 'there will be no expensive gimmicks and no excessive expenditure on show houses and unnecessary adornment'. When it is opened next year the Centre should have a strong appeal to the many thousands of medium and small dairy farmers who face the problem of raising the size of their businesses to meet current economic stresses. The age-old practice of 'looking over the hedge' is a piece of rural wisdom which has served generations of farmers very well indeed.

Books

Wood Preservation. (3rd Edition). GEORGE M. HUNT and GEORGE A. GARRATT. The American Forestry Series. McGraw-Hill, 1967. £5 8*s*.

This extremely detailed book on all aspects of wood preservation is divided into twelve chapters. Each is devoted to one aspect of the subject, the agencies of wood deterioration (two chapters), wood preservatives, preparation of material for treatment, wood-preserving processes, factors affecting penetration and absorption, economic aspects, properties of treated wood, treating plants and equipment, methods of protecting wood other than by standard preservative treatments and fire-retarding treatments. One cannot think of any aspect which has been omitted. There is a comprehensive list of references at the end of each chapter.

The book has been written for the American market, and the emphasis is on the preservation of large scantling timbers such as poles, cross ties (railway sleepers), pit-props, piling and wharf timbers, as few wood preserving plants in America have either the equipment or the sales organization to handle small orders of mixed building timbers.

This edition is not for the architect, builder or farmer who wishes to decide quickly the best specification for his particular problem, but it is an excellent treatise for the serious student of the subject. The historical aspect is dealt with in some detail, and this adds to the completeness of the work. The authors have also devoted a considerable amount of space to the chemistry of the preservatives.

The first chapter discusses arguments for preservation and deals briefly with the subject in the form of a preface. The agencies of wood deterioration are divided into fungi and bacteria, wood borers, fire, mechanical wear and weathering. The spread of decay by fungus is discussed in detail and the dangers of this form of decay are well known. What may not be so well known is that not only are the fungus spores wind-borne, but that they can also be distributed by insects and birds, and that the hyphae (fungus threads) will grow over inert substances such as brick and cement.

There is only one photograph illustrating wood boring insects and this is a poor reproduction of a *Lyctus* (powder post beetle), with a very 'diagrammatic' series of minute drawings of the relationships, stages and forms of the common eastern subterranean termite—*Recticulitermes flavipes* Kol. Termites have assumed a position of major importance in the United States and are particularly destructive in the south-western States and along the Pacific coast, but fortunately, are not a problem in this country. Several British pests such as the common furniture beetle, the death watch beetle and the house long horn beetle are not mentioned as they are either non-existent or not serious pests in America. The mention of woodpeckers among the insects is curious.

Fire as a wood-destroying agency is mentioned as the cause of spectacular damage, but the authors rank it secondary in importance to the relatively slow working and less obvious decay in the destruction of timber.

Lists of the usual preservatives are given in Chapter 4 and each is described in considerable detail. The points emphasized being that preservatives must be toxic to the organisms that feed upon timber, they must last at least 40-50 years and must penetrate to an appreciable depth. It is interesting to note that the authors disclaim the often repeated statement that brush application will give adequate protection to wood.

Under 'Preparation', is discussed the necessity for peeling the bark, methods of air seasoning, of end checking or closing split timbers and methods of incising the timber for deeper penetration and this is followed by a chapter dealing with the various methods of treatment, e.g., non-pressure such as brush and spray treatments, dipping, steeping, hot and cold bath and finally, the vacuum processes. Also mentioned is the treatment of living trees by injecting the sap stream with a preservative. The anatomy of wood is described and illustrated with enlarged drawings of the structure of a typical block of wood and a photomicrograph showing the wood structure. The economic aspects of preservative treatment with tables of typical cost figures for railway ties (sleepers) and the salvage value of old timber is also discussed.

Chapter 9 deals with the properties of treated wood in which the following points are mentioned as being important. Treatment must not reduce the load-carrying capacity of the timber, the effect on the

flamability of the timber must be considered, the fact that painting treated timber is sometimes necessary and the effect of the preservative on the gluing characteristics of the wood which is becoming increasingly important.

The methods of protecting wood other than by standard preservatives are described in Chapter 11 and there is included a list of seven cardinal principles of good building practice to avoid moisture accumulation and decay. The last chapter deals with fire-retarding treatments.

Finally, there is an Appendix which gives the standards for coal-tar creosote for land and fresh water use, and a list of the Federal Specifications dealing with the subject of wood preservation.

A.G.J.

Biological Methods of Crop Pest Control. GEORGE ORDISH. Constable, 1967. 30*s*.

Governments tend to respond to immediate pressures, economic, political, and military, and their vision seldom extends far beyond their term of office. Political leaders today give no more impression of being philosophers than they did in Plato's time. That being so, it would be quite unrealistic to expect them to act in accordance with a perspective of 50 to 100 years. If by some miracle they were to do so, they would unhesitatingly pour resources into research on the problems on which the future of the human race primarily depends —those involved in understanding and manipulating the numerical relationships between mankind and other animal and plant species, and in preserving this global habitat intact for the future generations that have a right to it. However, Albert Schweitzer has said: 'Man has lost the capacity to foresee and to forestall. He will end by destroying the earth'. One cannot with any confidence contradict him.

From such sinister prognostications, it is pleasant to turn one's attention to George Ordish's new book, which gives a popular account of the activities of those biologists who have been doing something to elucidate the relations between man and other organisms, and, in particular, to develop more intelligent means of manipulating the numbers of organisms in accordance with man's long-term interests.

In recent years there have been tremendous developments in forms of pest control that are biologically based, and it is not an exaggeration to say that there is an impending revolution in this field. Such developments as the use of sterile male release to eradicate insect pests, the introduction of lethal genes into pest populations and the employment of sex or other attractants to trap pests, and chemosterilants to sterilize them have opened up prospects of potentially unlimited scope for pest control based on profound knowledge of ecology, physiology and biochemistry.

The author helps to clarify for the general reader the present position in the application of biological and para-biological methods of pest control. He draws from original papers a considerable number of interesting observations and fascinating research stories that provide some appreciation of the diverse studies and problems that constitute this important field of research. Ordish's sources go back through the centuries even to classical times, and his quotations are always of interest.

One cannot agree with all the statements made, and the text can be criticized at various points, but it is not written for the specialist. It might have been wiser to direct the book purely to the intelligent layman having no special knowledge, and to leave out entirely such technical passages as the chapter dealing with theoretical considerations. The book is defective also in editorial detail. Nevertheless, there is an extremely large gap in popular publications in this field of science, and this volume goes some way to filling it. The book will, it is to be hoped, help to alert both public and politicians to the importance and promise of this branch of applied science, and to the need for greatly increased support for it.

F.W.

Chemistry and Technology of Fertilizers. A. V. SLACK. John Wiley and Sons, 1967. 40*s*.

This book is a revised reprint of the section on fertilizers in the second edition of the *Kirk-Othmer Encyclopedia of Chemical Technology*. It describes the rapid change that has taken place in the fertilizer industry since the early 1950s and outlines the chemistry and nature of the manufacturing processes that are now used in fertilizer production in the United States, Europe and other parts of the world.

The author and his colleagues at the Tennessee Valley Authority are known for their studies of the chemistry and technology of fertilizers. There can be few people so well placed to select material from the vast technical literature on fertilizer production and write an effective summary of it, including an account of the economics of current production methods, in no more than 142 pages.

The book begins with an outline of the elements of plant nutrition, the functions of the macro- and micro-nutrients and the types of fertilizers that are available to supplement these nutrients in soils. World fertilizer consumption is shown as having increased five-fold in the years 1945–65. The structure of the fertilizer industry is examined mainly as it occurs in the United States and the important position reached by liquid fertilizers in that country is noted.

The main part of the book deals with the chemistry and technology of production of the nitrogen, phosphate, and potash fertilizers and combinations of them. It covers sources of raw materials, production methods, production economics, chemical and physical properties of products, handling and shipping. It has a final section on micro-nutrients and the problems of incorporating them in fertilizers.

The volume is packed throughout with useful technical information and makes easy reading. It has a page of contents but is not divided into formal chapters, and sections follow each other without obvious separation; this makes it necessary to refer more than is usual to the contents or memorize the pages covering each section. There is a very good subject index and a selected bibliography containing 107 references.

The book should be of value to anyone wishing to have an authoritative review of the nature of the modern fertilizer industry, and also to agronomists and soil scientists as a reference to the nature and properties of modern fertilizer materials and products.

N.H.P.

Commercial Poultry. CLIVE TETLAW. (Farm Books Series No. 14). Cassell, 1967. 7*s*.

Everyone with an interest in the poultry industry could gain from reading this book. For school-leavers intending to continue their studies it will certainly stimulate their thinking and add to their knowledge.

As with all the books in this series the bold layout and good paragraphing are most helpful. The style is straightforward and practical and there are many useful summaries and tables. Of special value are the suggestions for follow-up work at the end of each chapter.

One cannot, however, wholly agree with the claim made in the introduction that the book 'covers the needs of . . . schools dealing with rural studies'. It certainly offers much information useful to schools but a simpler version omitting, for example, certain technicalities of management such as those relating to ventilation, manurial applications, lighting tables etc., would be more appropriate for the secondary pupils who are most likely to work from this book. The needs of schools would be better served by dealing in smaller units and in simpler terms than those used in *Commercial Poultry*.

Apart from this, it is a book which many students and teachers will be very pleased to use.

J.A.S.

Soil Biochemistry. Edited by A. D. MCLAREN and G. H. PETERSON. Edward Arnold, 1967. £9.

So much has been published on soil biochemistry that it is now impossible for one person to write a book covering the whole subject in detail. At the same time there has never been a greater need for authoritative and critical digests of the literature. Without such digests, research workers can only, at best, keep up to date in their own speciality, and anyone who wants to use the new knowledge will have the utmost difficulty collecting and collating it. Books like *Soil Biochemistry* are one answer to this problem.

This beautifully printed and produced book contains an introductory chapter by the editors, followed by sixteen chapters written by specialists. J. M. Bremner contributes a comprehensive article on the nitrogenous constituents of soil; G. Anderson thoroughly reviews the literature on organic phosphorus compounds in soil; U. C. Gupta reviews soil carbohydrates and F. J. Stevenson discusses organic acids, and, briefly, what they do in soil. C. Steelink and G. Tollin review the meagre information on the free radicals found in soil. In the second part of the book, C. C. Delwiche considers the energy balance of the soil, and N. E. R. Campbell and H. Lees briefly discuss nitrification, denitrification and nitrogen fixation. D. J. Cosgrove reviews the metabolism of organic phosphates, and J. R. Freney, after summarizing what is known about soil organic sulphur, discusses some of the transformations undergone by sulphur compounds. H. M. Hurst and N. A. Burges briefly review the chemistry and biochemistry of lignin and the humic acids. S. Dagley gives a detailed review of the microbial metabolism of phenolics, R. L. Huddleston and R. C. Allred consider the biological degradation of detergents, and J. J. Skujins gives a most useful review on enzymes in soil. On the more practical

side, there are two good chapters, one on the degradation of herbicides in soil by P. C. Kearney, D. D. Kaufman and M. Alexander, and one on the biochemistry of the rhizosphere by A. D. Rovira and B. M. McDougall. The final chapter, by Wolf Vishniac, relates terrestrial soil biochemistry to the soils of the planets. A most useful chapter, considering how much easier it is to get money for space research than for agricultural research.

It is unavoidable that the standard of such a book be uneven, if only because more is known about some aspects of soil biochemistry than others. The most serious criticism of this book must be directed to the editors for their choice of subjects. Whole chapters, for example that on free radicals, are devoted to topics where a page or two would be adequate. Other chapters would seem more appropriate in books on microbial metabolism or sewage treatment. Important topics, such as non-symbiotic fixation of nitrogen, the overall dynamics of carbon, nitrogen, and sulphur in soils, the role of organic matter in mobilizing the inorganic part of the soil, merit more comprehensive treatment than that given. Nevertheless, the essays in the book will be of interest and value to all concerned with the biology and chemistry of soil.

D.S.J.

Land and People. Papers given at Cambridge in the summer of 1966. Leonard Hill, 1967. 35*s*.

If present trends continue the population of England and Wales will increase by about a third by the end of the century. This will inevitably give rise to acute problems in the allocation of our limited land and water resources. Not only will the associated spread of urban development, motorways and airfields have to be reconciled with the need to expand agricultural production, but also provision will have to be made to meet the needs of an increasingly affluent and leisured society for recreation in the countryside.

It is with these problems that this book is concerned. Each Paper examines some particular facet of the difficulties which confront us in planning the right balance between the competing uses for land. They are presented by people eminent in their various fields and, as such, call for careful study by all persons interested in securing the optimum use of our land.

The introductory lecture by Mr. J. T. Beresford discusses the future of the countryside in an age of leisure and the form of the new agriculture which may emerge. This is followed by two Papers on the mechanism of planned land use. The first, by Mr. C. D. Pilcher, is a most thought-provoking Paper on public need and individual judgment in land use planning—a subject directly concerned with the maintenance of individual freedom in a planned society. In the second, Lord Nugent examines some of the trends and pressures bearing on land use planning and shows how some local planning authorities are effectively responding to them by voluntary co-operation.

Perhaps the most interesting Paper is that by Professor E. W. Hofstee. He analyses some of the ways in which increasing density of population has led to the steady erosion of private property rights and speculates on the future of land-ownership in highly populated industrialized societies. Professor J. N. Black then discusses the various categories of resource-ownership, and examines some of the problems of private and communal property ownership by reference to the management of fisheries and water resources. The book concludes with a chapter by Dr. D. R. Denman, who points to the need for a thorough re-examination of the concept of property.

Many readers will not agree with some of the views expressed in the various Papers, but none can fail to be stimulated by them.

D.J.G.

books received

Farm Organisation and Incomes in South West England 1966-7. Report No. 169. S. T. Morris, H. W. B. Luxton and G. D. D. Davies. University of Exeter. 7*s*. 6*d*.

ABC of Plant Terms. J. Gordon Cook. Merrow, 1968. 25*s*.

Results of Experiments at Experimental Husbandry Farms 1966. No. 14. Part I Crops. Part II Livestock. Ministry of Agriculture, Fisheries and Food.

Eggs in the Common Market. An Examination of the E.E.C. Regulations for Eggs and Egg Products Effective from 1st February 1968. Betty J. Roscoe and R. C. Rickard. University of Exeter.

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OFFICIAL APPOINTMENTS

FIJI—*cont.*

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Qualifications: A degree in Agriculture or Science with experience in practical soil conservation. Experience in tropical agriculture is desirable.

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Qualifications and Terms: Suitable teaching experience, and a degree in agriculture or agriculture engineering, with experience in irrigation.

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RC 213/150/03

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SARAWAK

Agricultural Chemist

RC 213/155/01

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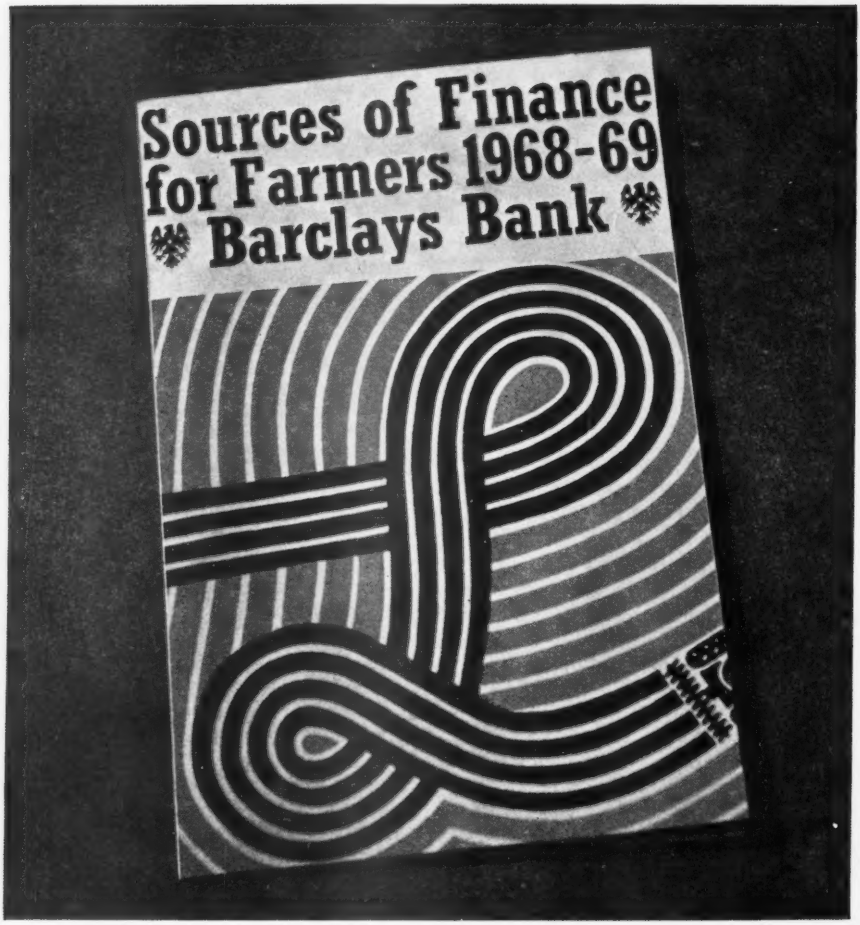

This is the current edition of Barclays guide to grants and loans available to farmers. Written in consultation with the Ministry of Agriculture, it is of proven value to farmers and others interested in agricultural finance. Copies may be obtained free from any branch of the Bank.

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